HISTORY OF SCIENCE AND TECHNOLOGY
TECHNOLOGY FOR GREEN ENERGY

# EUROPEAN PUPILS MAGAZINE

Year 9 - No. 25
Issue 1 - April 2011
I.S.S.N. 1722 6961

History of Science and Technology  Technology for Green Energy

# European Pupils *Magazine*

**EPM Official Website:** www.epmagazine.org
**EPM On Line Magazine:** epmirrorsite.xoom.it
**EPM CD Collection:** epmcd.ath.cx
**EPM Last Published Issue:** epmlastissue.ath.cx
**EPM Calendar 2011:** epmcalendar.ath.cx
**EPM 15th Meeting Blog:** epmagazine.org/storage/145/weblog.aspx

## International Editorial *Board*



## Web Team

| | | |
|---|---|---|
| **Webmaster** | **Rick Hilkens** | **webmaster@epmagazine.org** |
| Web Assistants | Giovanni Di Gregorio | giovanni92ct@hotmail.it |
| | Vittorio Iocolano | vittorio.iocolano@email.it |

## International Cooperators

| School | Coordinator | School | Coordinator |
|---|---|---|---|
| Catholic Univ. Brisbane | Natalie Ross | Taskopru Anadolu Lisesi | Senol Karabaltouglu |
| 127 Ivan Denkoglu | Tzvetan Kostov | Suttner-Schule | Norbert Müller |
| Liceul Teoretic I. Barbu | Marcela Niculae | Ahmet Eren Anadolu Lisesi | Okan Demir |
| Colegiul Tehnic Mihai. Bravu | Crina Stefureac | Università di Salerno | Nicla Palladino |
| Nat. Inst. Lasers, Plasma and Radiation Physics | Dan Sporea | Priestley College | Shahida Khanam |
| | | Gh. Asachi Technical | Tamara Slatineanu |

**Layout by:** Anamaria Grofu and Mattia Masciarelli, Catania, Italy
**First Cover:** *Green Energy – Lifelong Learning by E. Lacatus*

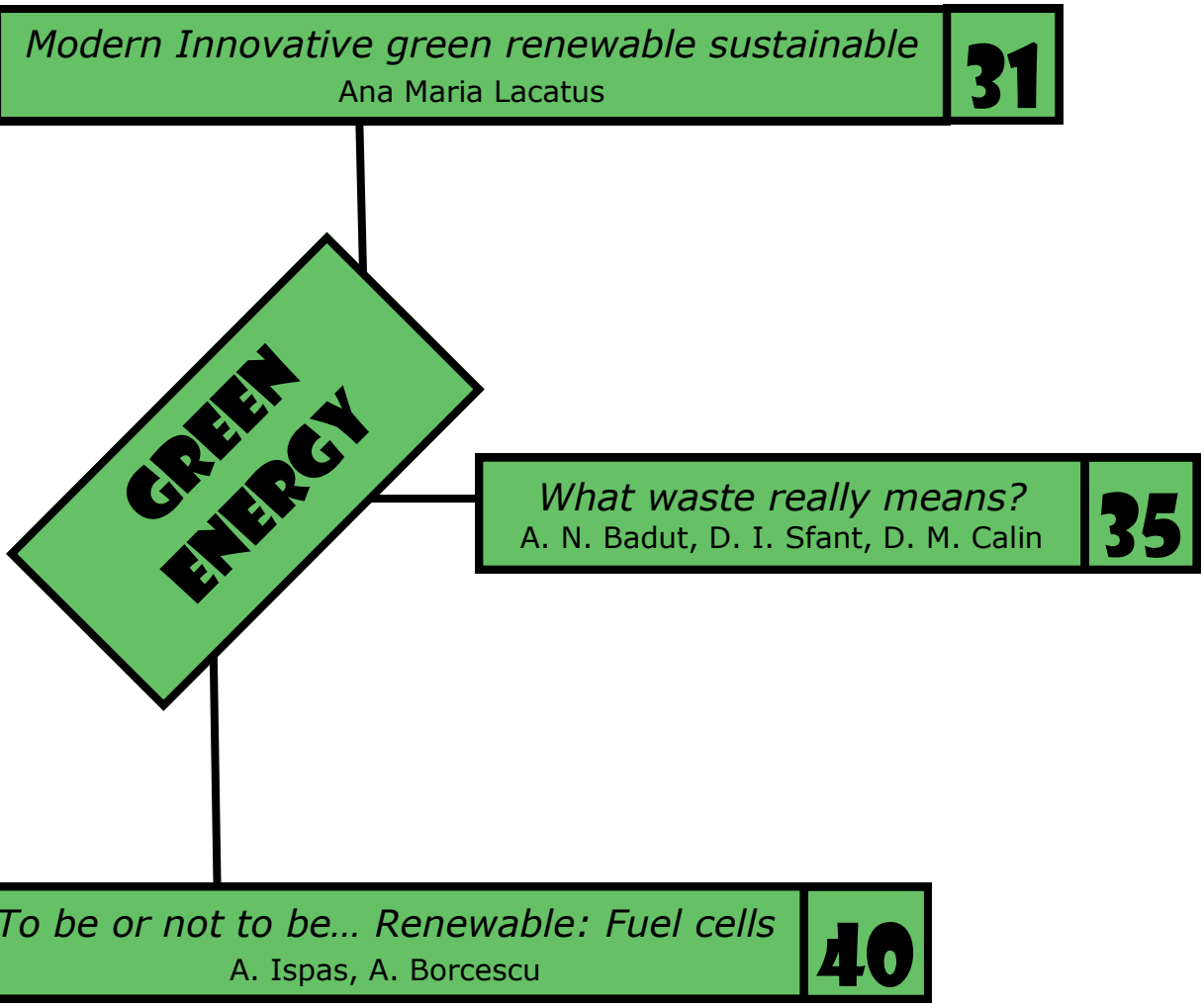
HISTORY OF SCIENCE AND TECHNOLOGY
TECHNOLOGY FOR GREEN ENERGY

# EUROPEAN PUPILS MAGAZINE

## INDEX

HISTORY OF SCIENCE AND TECHNOLOGY
TECHNOLOGY FOR GREEN ENERGY

# EUROPEAN PUPILS MAGAZINE



Politehnica University of Bucharest

Bucharest, Romania
EPMagazine.ro@gmail.com



# *Editorial*

## *Editorial*

***Life is what happens to you while you're busy making other plans***, John Lennon. The student's life in Engineering Science is not so generous to allow you to think of extra cultural domains. The funny thing is that when you thought that you don't even have time for a snack, a devoted person to science and research appears and presents you a challenge that you can't resist. Why? Because it is something new, because it is a European level magazine, and last but not least because you love challenges. This way you end up making a 3 weekend's long research and another 3 to piece it up together to shape up a preliminary version of the article. Finally the words take shape in the idea that you wanted to say at an particular scientific level, and you have the beautiful feeling that you finished it. You begin to consider yourself an academician, but then some else make sure to notify you that you are far from it.

With little experience and a lot of enthusiasm, you take your responsibility seriously of managing the editorial. It is very incredible how the minutes pass when you concentrate to make a thing end up at its best. The effort, the time assigned for this experience gives birth to a new passion: the desire for writing further. Slow, without noticing, the thirst for work and documentation takes over.

***Viata este ceea ce ti se intampla atunci cand esti ocupat sa faci alte planuri*** spunea John Lennon. Viata de student in Stiinte Ingineresti nu-i atat de generoasa cu timpul liber incat sa-ti permita sa te gandesti si la alte domenii culturale. Poate de aceea este ciudat ca atunci cand nu ai timp nici macar pentru o gustare apare cineva - pe care il simti ca este cu adevarat dedicat cercetarii si stiintei- si iti lanseaza o provocare careia nu i te poti impotrivi. De ce? Greu de spus: poate pentru ca e ceva nou sau pentru ca e vorba de o revista la nivel european si nu in ultimul rand pentru ca iti place sa accepti provocarile. In acest fel ajungi sa faci ceva ce nici nu visai ca vei face cu numai cateva zile mai devreme: te documentezi trei weekend-uri si iti mai petreci inca trei pentru a pune informatiile cap la cap, pentru a da forma preliminara unui articol. In sfarsit cuvintele contureaza ceea ce ai vrut tu sa exprimi si ai impresia ca ai terminat. Te consideri deja academician, viata devine frumoasa, dar aceeasi persoana care ti-a oferit ***provocarea*** are grija sa te anunte ca ***mai e mult pana departe***.

Cu putina experienta si mult entuziasm iti iei in serios responsabilitatea de a te ocupa de editorial. Este absolut incredibil cum trec minutele atunci cand te concentrezi ca un lucru sa iasa bine. Efortul depus, timpul alocat acestei experiente dau viata unei alte pasiuni: aceea de a scrie in continuare. Usor, usor, fara sa iti dai seama, te cuprinde setea de lucru si de documentare. Este o experienta care ne-a facut sa descoperim cu uimire ca sunt multe persoane dornice de incursiuni culturale. Satisfactia lucrului dus la bun sfarsit intr-un

It is an experience that has shown us that there are many other persons that are in need of new cultural experiences and even editorial ones. The satisfaction that you have brought from start to finish an activity in an domain entirely new with the collaboration and sincere enthusiasm of the other European editorial collectives has shown us how an unplanned activity, can become more important than the one planned out, and increases in direct proportion to involvement in the process. If you are a student, and have free time there are at least five other activities capable of taking over at any time, the subjectivity of the hierarchy being on extremely sensitive matter. If a year ago someone told me that I would spend gladly my free time working on this project, I would have looked at him (IF I looked) with plenty of reserve and maximum doubt.

In all the time that has been spend working for **EP*Magazine***, it has been forgotten of the technological equipment and devices, of the algorithms and methods, of the deadlines of the ongoing projects.. We have learned the meaning of collaboration and how important is work team.

We have discovered that in any domain, if you want to be heard with interest, it is important to become a good professional and learn to collaborate. There are things that you learn from the others and you can forget easily, and there are things that you learn on your own experience and never forget.

An old Romanian saying: ***experience is the mother of learning***. We are confident that we have learned and continue to learn many things, in different fields, in the ***European family*** **EP*Magazine***

domeniu cu totul nou, colaborarea si entuziasmul sincer al celor cu experienta din celelalte colective editoriale europene, ne-au facut sa descoperim cum o activitate neplanificata poate deveni mai importanta decat una planificata si cum importanta creste direct proportional cu implicarea personala. Ca student, daca ai timp liber mai sunt cel putin alte cinci activitati capabile sa-l ocupe in orice moment, subiectivitatea ierarhizarii fiind o problema extrem de sensibila. Daca in urma cu un an ne-ar fi spus cineva ca ne vom petrece bucurosi timpul liber lucrand pentru proiecte l-am fi privit (daca l-am fi privit) cu multa rezerva si maxima indoiala.

Atat timp cat s-a lucrat pentru **EP*Magazine*** s-a uitat de echipamente si dispozitive tehnologice, de algoritmi si modele si de etapele scadente ale proiectelor in derulare. Am invatat intr-adevar ce inseamna colaborarea si cat de important este lucrul in echipa.

Am descoperit ca in orice domeniu daca vrei sa te faci ascultat, chiar de catre cei de aceeasi varsta cu tine, este necesar sa devii un bun profesionist si sa inveti sa colaborezi.

Un proverb romanesc zice: ***experienta este mama invataturii***. Suntem convinsi ca noi am invatat si continuam sa invatam foarte multe lucruri, in diverse domenii, in cadrul ***familiei europene a*** **EP*Magazine***

# Editoriale

***La vita è ciò che ti accade mentre sei occupato a fare altri progetti***, J. Lennon. La somma tra le attività legate all'ingegneria e quelle dello studente ci impedisce di pensare ad altre attività. La cosa strana è che mentre pensi di non avere nemmeno il tempo per uno spuntino arriva improvvisamente qualcuno appassionato di scienza e di ricerca che ti pone una sfida irresistibile. Perché? Perché c'è qualcosa di nuovo, perché c'è una rivista Europea per studenti e da ultimo, e non meno importante, perché ami le sfide. Perciò finisci per trascorrere tre fine settimana facendo una ricerca e altri tre mettendone insieme i risultati. Alla fine ne esce un articolo scientifico e hai la sensazione di aver portato a termine un lavoro bellissimo e ti senti quasi un accademico, ma poi qualcuno ti riporta con i piedi per terra.

Con poca esperienza e molto entusiasmo ti assumi la responsabilità di scrivere l'editoriale; i minuti passano veloci mentre ti concentri per fare del tuo meglio e ciò ti suscita una nuova passione, quella di scrivere ancora; a poco a poco ti lasci prendere dalla voglia di fare ancora ricerche e produrre nuovi articoli.

Questa esperienza scientifico-educativo-didattica ci ha dimostrato che esistono altre persone con la voglia di esprimersi. Ci procura soddisfazione costatare che un'attività imprevedibile genera maggiore gioia di un'attività ben pianificata; e tale gioia cresce in modo direttamente proporzionale al coinvolgimento nel processo.

Da studente il tempo libero sembra non esistere perché ci tuffiamo sempre in nuovi progetti.

In questo progetto abbiamo anche imparato l'importanza della collaborazione e del

# Εκδοτικό Σημείωμα

***Ζωή είναι αυτό που σου συμβαίνει, ενώ είσαι απασχολημένος κάνοντας άλλα σχέδια***, Τζον Λέννον. Οι σπουδές μας στο Πολυτεχνείο, αλλά και οι φοιτητικές μας ενασχολήσεις μερικές φορές μας αποτρέπουν να σκεφτόμαστε άλλες επιπλέον δραστηριότητες. Το αστείο είναι ότι όταν σκέφτεσαι ότι δεν έχεις χρόνο ούτε για ένα σάντουιτς, εμφανίζεται κάποιος κολλημένος με την επιστήμη και την έρευνα και σου παρουσιάζει μια πρόκληση στην οποία δε μπορείς να αντισταθείς. Γιατί; Επειδή είναι κάτι καινούργιο, επειδή είναι ένα πανευρωπαϊκό περιοδικό, και τελευταίος λόγος, αλλά όχι λιγότερο σημαντικός, γιατί σου αρέσουν οι προκλήσεις. Έτσι για να τελειώσεις ένα άρθρο κάνεις τρεις εβδομάδες έρευνα, και άλλες τρεις για να βάλεις σε σειρά τα δεδομένα σου. Στο τέλος οι λέξεις φτιάχνουν ένα επιστημονικό άρθρο, και έχεις το ευχάριστο αίσθημα ότι τελείωσες. Αρχίζεις να θεωρείς τον εαυτό σου έναν ερευνητή, αλλά ύστερα κάτι γίνεται για να σου θυμίσει ότι είσαι, ακόμη, μακριά από αυτό.

Με λίγη εμπειρία και πολύ ενθουσιασμό, αναλαμβάνεις υπεύθυνα να ετοιμάσεις το εκδοτικό σημείωμα. Είναι πολύ περίεργο, πώς περνούν τα λεπτά όταν συγκεντρώνεσαι για να ολοκληρώσεις μια δουλειά με τον καλύτερο τρόπο. Η προσπάθεια, ο χρόνος που αφιέρωσες για αυτήν την εμπειρία γεννάει ένα νέο πάθος: την επιθυμία να γράψεις περισσότερα. Αργά, χωρίς να το καταλάβεις, η δίψα για δουλειά και για αναζήτηση δεδομένων σε συνεπαίρνει.

Είναι μια εμπειρία, που μας έδειξε ότι υπάρχουν κι άλλα, πολλά άτομα, πρόθυμα να εκφραστούν. Η ικανοποίηση που νοιώθεις από την αρχή μέχρι το τέλος μιας δραστηριότητας, που δεν υπήρχε στα σχέδιά σου, γίνεται πιο σημαντική από μια σχεδιασμένη, και αυξάνεται

lavoro di gruppo. Se vuoi essere ascoltato, devi diventare un buon professionista e imparare l'arte della collaborazione. Ci sono cose che impari dagli altri e che dimentichi e cose che impari da solo e che non ti scordi mai. Un vecchio proverbio Romeno dice: ***l'esperienza è la madre dell'apprendimento***.

## Уводна статия

***Животът е това, което се случва с вас, докато сте зает с правене на други планове*** - Джон Ленън. Сумата на инженерингoвата дейност и студентски дейности понякога ви спира да мислите за допълнителни дейности. Смешното е, че когато си мислите, че дори нямате време за закуска, лице, свързани с научно-изследователска работа се появява и ви представя едно предизвикателство, на което не можете да устоите. Защо? Тъй като това е нещо ново, защото това е европейско списание, и не на последно място, защото обичате предизвикателствата. По този начин прикючвате дълги изследвания в 3 съботи и недели, и още 3 да ги подредите заедно. В крайна сметка думите съставляват научна статия, и вие имате красивото чувство, че сте я завършил. Започвате да се считате за академик, но след това някой друг, не забравя да ви уведоми, че сте далеч от това. С малък опит и много ентусиазъм, вие вземате на сериозно отговорността си за редактирането на броя. Много е подозрително как бързо текат минутите, когато се концентрирате да направите нещо, и да го завършите по най-добрия начин. Усилията, времето, предвидени за този опит раждат нова страст: желанието за

όσο περισσότερο δραστηριοποιείσαι. Αν είσαι φοιτητής, και έχεις ελεύθερο χρόνο, έχεις την εντύπωση ότι τον έχασες, επειδή πρέπει να επικεντρώσεις όλη την προσοχή σου στο στόχο σου και σ' αυτά που μπορείς να αποκομίσεις, εμπλέκοντας τον εαυτό σου σε τέτοιες δράσεις (projects). Μάθαμε, όμως, να συνεργαζόμαστε και πόσο σημαντικό είναι να δουλεύουμε σαν ομάδα. Αν θέλεις να ακουστείς, είναι απαραίτητο να είσαι καλός στη δουλειά σου και να μαθαίνεις να συνεργάζεσαι. Υπάρχουν πράγματα που μαθαίνεις από τους άλλους και μπορείς να τα ξεχάσεις εύκολα, και υπάρχουν πράγματα που μαθαίνεις μόνος σου και δε τα ξεχνάς ποτέ. Μια παλιά ρουμανική παροιμία λέει: Η εμπειρία είναι η μητέρα της γνώσης.

## Başyazı

John Lennon bir röportajında ***Hayat, siz başka planlar yaparken başınıza gelenlerdir*** demiştir. Mühendislik bilimleri öğrencisi olmak hayatınızı ciddi anlamda kültür üzerinde düşünemeyecek kadar yoğun bir hale dönüştürür. Siz bir şeyler atıştırmak için bile zaman olmadığını düşündüğünüz anda bilim ve teknolojiye düşkün olduğunu bildiğiniz biri sizin reddedemeyeceğiniz bir kültürel meydana okumayla karşınıza çıkarsa bunu bilmek gerçekten tuhaftır. Neden? Söylemesi güçtür. Belki uzman denetimli bir Avrupa Dergisi olmak yeni bir şey olduğundan yada bizim meydan okumaları sevdiğimizdendir. Böylece biz fark ettik ki hayal dahi etmediğimiz bir şeyi yapıyoruz: Makalenin ön hazırlığını yapmak için üç hafta sonu belgelendirme ve üç hafta sonu da verileri birleştirmekle uğraşmak için üç hafta sonu belgelendirme ve üç sonu da kelimleler başta bizim söylemeyi düşündüğümüz şeyleri söylemeye başladı. Sonra kendimize daha saygıyla bakmaya başladık, hayat daha güzel görünmeye başladı; ama bu rüya devam etmeyecekti. Bize meydan

по-нататъшно писане. Бавно, без да забележите, жаждата за работа и документиране надделява.

Това е преживяване, което ни показа, че има много други лица, които имат желание да изразят себе си. Личното задоволство, че сте довели от началото до края непланирана дейност, но ставанала по-важна от планираната е в пряка зависимост от участието Ви в този процес. Ако сте студент и имате свободно време, можете да получите впечатлението, че тя не съществува: ето защо вие трябва да съсредоточите напълно вниманието си на този въпрос, и това нещо можете да постигнете, като се включите в проектите. Ние научихме смисъла на сътрудничество и колко е важна екипната работа. Ако искате да бъдете чути, е необходимо да бъдете добър професионалист и да започнете да се учите да си сътрудничите. Има неща, които се учат от другите и можете лесно да забравите, но има неща, които сте научили сами и никога няма да забравите. Една стара румънска поговорка гласи: ***Опитът е майка на ученето***. Ние сме уверени, че сме се научили и продължаваме да се учим на много неща, в различни области, в европейското семейство **EP *Magazine***.

okuyan aynı kişi koşmamız gereken yolu göstererek bizi yeryüzüne döndürdü: daha çok yolumuz var... Şimdiden biraz tecrübe ve bol miktarda coşku ile başyazıya yaklaşıyorduk. Zor olmamalıydı ve bir konuya odaklanmışken zamanın ne kadar çabuk geçtiğini görmek inanılmazdı. Tüm çaba ve harcanılan onca zaman yeni bir yazma tutkusu meydana getirdi ve adım adım taslağımız bizim duygusal ve kültürel zenginliğimize göz kırparak başyazıya dönüşmeye başladı. Bu takım çalışması yöntemi birbirimizin sanatsal yeteneklerini ve gizli hassasiyetlerimizi keşfetmemizi sağladı ve bize karmaşık bir görevi başarma ölçütünü verdi.

Bizim önceki yayın kurulunun coşku desteğini almak gibi bir avantajımız vardı ve böylece planlanmamış faaliyetlerin planlanmış faaliyetlerden daha önemli olabileceğini görmek bizi şaşırttı ve önemin burada bir bağlılık işlevi olduğu vurgulanabilir.

Bir öğrenci olarak boş zamana ulaşmak faaliyetlerinizi dikkatli bir şekilde sınıflandırmanız anlamına geliyor ve her türlü öznel kriter buna konu olabilir. Eğer bir yıl önce birisi kalkıpta bize bir gün gelecek boş zamanımızı bir proje üzerinde seve seve çalışarak geçireceğimizi söyleseydi ona son derece şüpheli gözlerle bakardık (tabi eğer ona bakarsak).

EP dergisi için çalıştığımız süre içinde teknoloji ve cihazların dünyasını unuttuk, modellerden ve algoritmalardan, planlı proje bitiş tarihlerinden uzaktık ama takım çalışması ve iş birliğinin anlamını keşfettik. Anladık ki hangi alanda çalışırsak çalışalım kendi yaşıtlarımıza dahi sesimizi duyurmak için daha sorumlu davranmamız ve deneyimlerimizi takımımızla paylaşmamız gerekiyor.

Eski bir Romanya ata sözü der ki; pratik yapmak öğrenmeyi besler. Kesinlikle EP Dergisi ailesinde çok şey öğrendik ve öğrenmeye devam edeceğiz.

National College
*Mihai Viteazul*

14
16

Bucharest, Romania
anailinca@hotmail.com

**Ana Ilinca FOTA**

# *When scientists are playing*

## *Cand oamenii de stiinta se joaca*

Even if it seems strange to imagine adults playing, at least honorable scientists, as long as *playing* ***refers to a range of voluntary, intrinsically motivated activities that are normally associated with pleasure and enjoyment*** and it has been proved as being an imperative for all higher-functioning of animals, then… adults are allowed to play.

**Figure 1 Johannes Kepler**

What happens when scientists are playing …this is already a *statistical* story!

For example, Johannes Kepler (1571-1601), already famous for his researches at the time – being the imperial astronomer of Rudolph II (1552-1612) - wrote an essay ***On the Six-Cornered Snowflake.***

Playing with words (in Latin – the language of the essay - ***nix*** meaning *snowflake*, but in German – the native language of the author- ***nix*** meaning *nothing*). Even if circumstantial and not scientific reasons made him at first to write the essay, the scientist overcomes the common issues and finally he concluded that a snowflake might be a perfect Christmas gift ***since it comes down from heaven and looks like a star***.

Chiar dacă pare ciudat să-ți imaginezi adulţi jucându-se, cel puţin oameni de ştiinţă, atât timp cât joaca ***se referă la o serie de activităţi voluntare, motivate intrinsec care sunt asociate în mod normal cu plăcerea şi bucuria*** s-a dovedit ştiinţific că ea este necesară pentru dezvoltarea capacităţilor funcţionale a tuturor animalelor... atunci le este permis și adulţilor să se joace.

Ce se întâmplă când oamenii de știință se joacă?... Asta devine deja o problema de statistică!

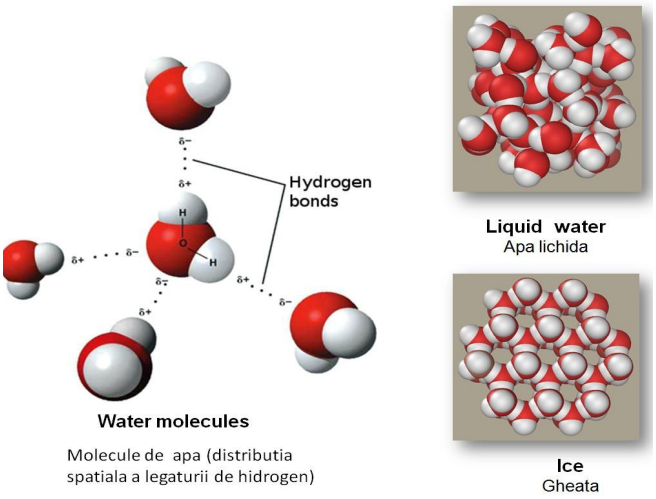



**Figure 2**

De exemplu, deja faimos pentru cercetările sale in domeniul geometriei și al astronomiei Johannes Kepler (1571-1601), astronom imperial la curtea împaratului Rudolf II, scrie un eseu despre ***Fulgul de nea in șase colțuri*** jucându-se însă cu înțelesul cuvintelor – în lb. latină ***nix*** înseamnă *fulg de nea*, câtăvreme în lb. germană același ***nix*** însemnă *nimic-.*

Chiar dacă eseul a avut inițial motivații

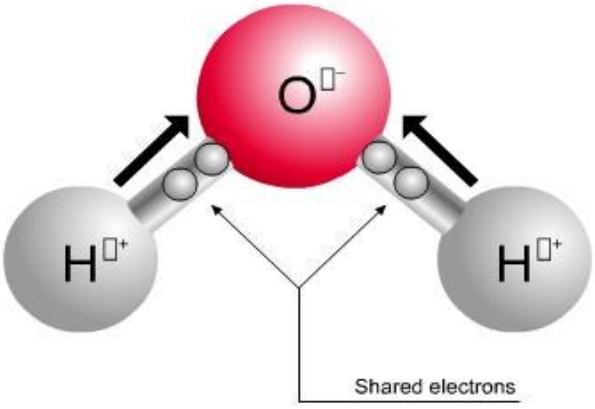



**Figure 3**

From this point on the essay talks about geometrical figures, being the very first known published work that describes and analyses the structure of the ice crystals, even on lyrics.

For him the beautiful six-cornered snowflake was just another marvelous example of the natural harmony concept. However, fascinated by *harmony* and relating the concept of *congruence* to diverse categories of the physics (three dimensional geometry, relationships among different species of magnitude, principles of consonance in music, organization of the Solar System) Kepler considered the *Harmonices Mundi* (*The Harmony of the World*, 1619) his most important work.

But water and especially its crystals continued to puzzle and fascinate scientist over centuries.

We've been taught from the earliest ages that water is the basic substance for life on Earth, and we never doubt it but step-by-step we discovered even more.

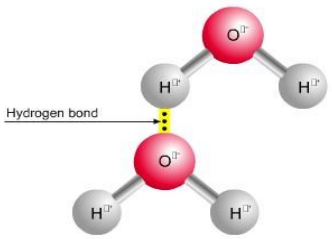



**Figure 4**

mai curând sociale decât științifice în cele din urmă cercetătorul s-a lasat fascinat de realitatea observată ajungând la concluzia că în lipsa altor mijloace fulgul de nea poate fi cel mai potrivit dar de Crăciun ***de vreme ce coboară din cer și arată ca o stea***.

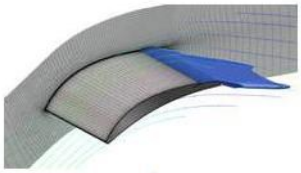
În continuare însă cheia eseului se schimbă, observațiile devenind mai curând geometrice decât literare, astfel încât se poate spune că este prima lucrare știută care descrie structura cristalelor de gheață, chiar dacă o face într-o manieră literară. Pentru Kepler frumosul *fulg de nea în șase colțuri* era un exemplu în plus ce venea să susțină conceptul *armoniei universale* și să-l lege prin *congruență* de diverse alte forme și relații (geometria tridimensională, relațiile dintre ordinele de mărime, principiile consonanței în muzică, organizarea sistemului solar). Kepler (fig.1) a considerat că opera lui de căpătâi a fost *Harmonices Mundi.*

Dar apa și mai ales cristalele acesteia au continuat să uimească și să fascineze cercetătorii de-a lungul secolelor.

De la cele mai fragede vârste ni s-a spus că apa este esențială pentru existența vieții pe Pământ și nu ne-am îndoit de asta, dar încet-încet am aflat tot mai multe lucruri despre apă. Ea acoperă 70,9% din suprafața Pământului dar reprezintă și aproximativ 70% din compoziția corpului uman și între 2% și 98% din cea a altor viețuitoare și plante. Este prezentă peste tot, susține viața în forma pe care o cunoaștem și proprietățile ei par să ne fie cunoscute. Oricum, se pune întrebarea ce o face atât de unică și indispensabilă existenței vieții pe Pamânt?

Monoxidul de dihidrogen ($H_2O$), substanța fără gust, inodoră și incoloră cunoscută sub numele comun de *apă*, spre deosebire de alte hidruri care sunt în stare

a



b

**Figure 5**

Water covers 70,9% from the Earth's surface, as well it represents about 70% of the human body composition and between 2% and 98% of the other living forms (plants and animals). It is widely present, supports life as we know it and its properties seem to be largely known However, what makes it unique and indispensable for Live on the Earth? Dihydrogen monoxide ($H_2O$), the tasteless, odorless and, up to an extent, colorless substance commonly named *water*, unlike other hydrides (which are on gas phase at normal temperature, e.g. hydrogen sulfide) remains liquid on normal conditions. Even more, its solid phase (ice) is floating onto the liquid one being less dense than the liquid one (fig. 2). Actually, water is the only known substance on Earth where the maximum density of mass does not arise when it becomes solidified but at around 4 °Celsius, in liquid phase; thereafter, freezing it expands rapidly gaining almost 9% by volume due to the spatial arrangement and the electrochemical properties of the molecules (fig. 3).

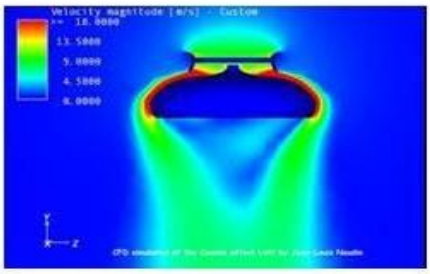
The very simple atomic structure of water causes its molecule to have electrochemical unique properties; the hydrogen side of the molecule has a slight positive charge while the other side has a negative one.

This makes water a powerful solvent able to solve-minerals from soil and next its very high surface tension, responsible for capillary action, helps feeding plants making gazoasă în condiții normale de temperatură (de exemplu, hidrogenul sulfurat), în condiții normale se prezintă în stare lichidă.

Water vortex

Aerodyne (Coanda)

a



b

**Figure 6**

Mai mult, faza solidă (gheața) plutește în cea lichidă fiind mai puțin densă decât aceasta (fig.2). Este singura substanță cunoscută până în prezent a cărei densitate de masă maximă este atinsă în faza lichidă (la aproximativ 4 °C) și nu în fază solidă, pentru ca pe măsură ce înghață să câștige aproape 9% în volum datorită aranjării spațiale a moleculelor (fig. 3, 4)

Structura atomică simplă a apei face ca moleculele acesteia să aibă proprietăți electrochimice unice; partea moleculei care conține hidrogenul are o sarcină slab pozitivă, in timp ce partea opusă are o sarcină slab negativă.

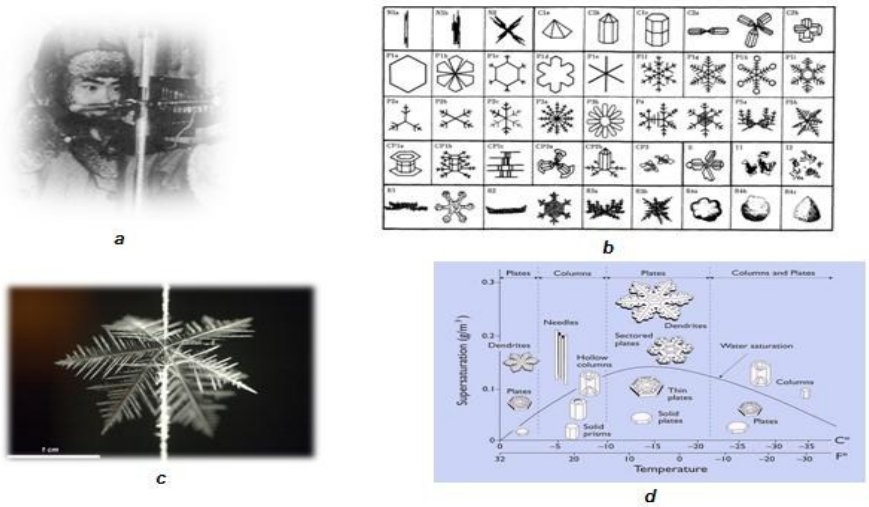
Aceasta particularitate electrochimică face ca apa să fie un solvent puternic, capabil să dizolve mineralele din sol și prin alte proprietăți fizice caracteristice (tensiune superficială și capilaritate) să hrănească plantele și animalele făcând posibilă viața pe Pământ. Apa mai are și alte proprietăți uimitoare, cum ar fi *ciclul*

life possible on Earth. Water has many other amazing properties, like its complete natural-cycle taking only nine days- the most perfect example of what re-newable must mean in the very essence of the concept; its vapor phase movement through atmosphere and its liquid / solid phases transformation determine the climate on Earth. Consequently, water is a challenging substance that continues to puzzle scien-tists.

a b

**Figure 7**

Few centuries later, an another scientist, the well known Romanian academician and engineer, aviation pioneer and the inventor of the modern jet aircraft Henri Coanda (1886-1972) was fascinated by harmony, symmetry and fluids' flow. His aerodynamic effect now known as the ***Coanda Effect*** (patented in France, 1934) would not be discovered if the author wouldn't be an ad-



a b c d

**Figure 8**

*complet* pe care-l descrie în natură pe parcursul a doar nouă zile, un exempu perfect a ceea ce înseamnă cu adevărat procesul de regenerare; deplasările vaporilor, transformările de fază și precipitațiile determină variațiile climatice pe Pamânt.

Prin urmare, apa este o substanță misterioasă care continuă să intrige oamenii de știință.

După Kepler, câteva veacuri mai târziu, un alt om de știință –academician, inginer, pionier al aviației și inventator al avionului cu reacție- românul Henri Coandă (1886-1972) este la rândul său fascinat de armonie, simetrie și de curgerea fluidelor. *Efectul aerodinamic* descoperit de el, cunoscut astăzi sub denumirea de ***efect Coandă*** (brevetat în Franța, 1934) n-ar fi fost descoperit atunci dacă autorul n-ar fi fost un observator avizat și un bun cunoscător al fenomenelor de mecanica fluidelor (fig. 5, 6).

Mai mult decât atât, între incidentul cu scurgerea de carburant din 1910 care a compromis modelul *Coanda-1910* prezentat la cel de-al doilea Salon Aeronautic de la Paris și anul inregistrării brevetului *efectului aerodinamic* (1934) Coandă descoperise domeniul fascinant al proprietăților apei (după cum menționa într-un interviu) și devenise fascinat (pentru tot restul vieții) de misterul cristalizării acesteia (fig. 7a, b). De fapt, efectul Coandă aplicat în aerodinamică, poate fi observat și în curgerea apei, formarea turbioanelor și a altor modele din dinamica fluidelor (fig. 5a, 6a) care au fost studiate de autor mai întâi în medii fluide mai usor de observat și măsurat (apa) și apoi

vised observer and a good analyst on fluid mechanics' phenomena (fig. 5, 6).

Moreover, between the 1910's fuel leaks incident that jeopardized his *Coanda-1910* airplane model at the second International Aeronautic Salon in Paris and the year of the *Aerodynamic Effect* patentee (1934)

a b c

**Figure 9**

Coanda discovered (as he mentioned in one of his interviews) the amazing properties of water, on its different phases, and he become fascinated (for the rest of his life) on its crystallization (fig. 7a, b). Actually the aerodynamic *Coanda effect*, as it can be observed on water flow, vortex and other powerful dynamic models were studied by Coanda firstly on more viscous fluid (water) and then adapted to the gasses dynamics. Those modeling steps made seventy years ago making easier the computer modeling of nowadays (fig. 5a, 6b). Even if he didn't published any work based on his water and snow studies, he invented a machine to make artificial snow, firstly for study reasons, but later on this became the first source of artificial snow produced for the ski slopes (France, 1930's). In 1963 Coanda presented a test model of a shrouded Coanda Effect internal nozzle he designed for underwater propulsion using steam as the primary fluid. However, his publicly known scientific activity has been focused mainly on aerodynamic area, but one life-long passion remained the study of

transpuse dinamicii gazelor. Acei pași de modelare experimentală făcuți în urmă cu mai bine de șaptezeci- optzeci de ani au făcut posibilă astăzi modelarea cu ajutorul calculatorului (fig. 5b, 6b).

Chiar dacă Henri Coandă nu și-a publicat studiile despre apă și cristalizarea ei, el a inventat o mașină pentru a obține zăpadă artificială, inițial ca suport al studiilor pe care le întreprindea, dar mai târziu aceasta a devenit prima sursă de zăpadă artificială pentru întrecerile de schi (Franța, în anii 1930). În 1963 Coandă prezintă la NASA un model de duză cu efect Coandă care era proiectată pentru propulsia subacvatică și utiliza aburul ca fluid primar. Oricum activitatea sa științifică cunoscută a rămas focalizată în domeniul aerodinamic, către studiul cristalizării apei - care l-a pasionat o viață – îndrumându-i pe tinerii de excepție pe care i-a intâlnit la un seminar organizat la NASA (1964) ambiționându-i să rezolve misterele ascunse în apă și gheață.

Între timp în Japonia, la mijlocul secolului XX într-o perioadă în care oamenii nu-și împărtășeau ideile in timp real prin WWW cum se întâmpă astăzi, un alt om de știință și-a dedicat întrega viață studiului cristalelor de gheață. Cunoscutul fizician și cercetător al fenomenelor legate de zăpadă și gheață, Nakaya Ukichiro (1900-1962) (fig. 8a), a lăsat un sistem de clasificare a cristalelor de gheață (fig.8b) bazat pe observațiile pe care le-a făcut cu echipamentele cele mai performante din acel moment dar și cu cele pe care le-a construit special pentru a obține zăpada artificială în laborator (fig. 8c). Foarte


**Figure 10**

ice, encouraging promising young scientists on a think-tank at NASA (1964) to solve the mysteries of water and ice.

Meanwhile, at the middle of the 20th century when people didn't shared their ideas through World Wide Web in no time as we do now, another scientist, in Japan, dedicated his entire life to the study of ice crystals. The famous Japanese physicist and scientist of snow and ice Nakaya Ukichiro (1900-1962) (fig. 8a) left a clearly settled classification of snow crystals (fig. 8b), using for his observation the best existing characterization equipments of his time and designing an equipment for making artificial snow on lab conditions (fig. 8c). Interesting, hundreds years after Kepler's essay to Snowflake another scientist have to wrote ***...snow crystals may be called letters sent from heaven*** (Ukichiro Nakaya, Snow Crystals, 1939). Worshiping his research on natural and artificial (fig. 8b) snowflakes, a Museum of Snow and Ice – a hexagonal building remembering the six cornered shape of snowflakes- has been raised at Ishikawa, Japan. And the snowflake story continued; based on Ukichiro's published studies few years later a complete diagram showing the dependence: supersaturation, temperature and snowflake form was published (fig. 8d). Then suddenly, especially in the last two decades, the scientific research tools improved essentially and the characterization and all previous observa-

interesant, sute de ani după eseul lui Kepler un alt om de știință avea să scrie ***cristalele de gheață pot fi numite scrisori trimise din cer***. Prețuindu-i munca de cercetare în studiul zăpezii naturale și artificiale (fig. 8c) japonezii i-au dedicat lui Nakaya Ukichiro un *muzeu al zăpezii și gheții* la Ishikawa, o clădire de formă hexagonală amintind de forma fulgului de nea. Povestea fulgului de nea continuă; pe baza studiilor publicate de Ukichiro și alți cercetători s-au ocupat de analiza cristalizării apei, astfel încât cîțiva ani mai târziu avea să fie definită o diagramă completă capabilă să coreleze suprasaturarea, temperatura și forma fulgilor de nea (fig. 8d).

Apoi cercetările și-au schimbat dinamica odată cu perfecționarea echipamentelor de observare și de caracterizare, dar mai ales odată cu apariția microscopiei electronice (fig.9). De această dată au fost create centre de cercetare dedicate studiului cristalizării la toate marile universități din lume și cele mai multe dintre acestea desfășoară programe speciale de studiu al gheții și zăpezii, încercând să rezolve în mod special sensibila problemă a modelării și simulării procesului de cristalizare la definirea formei fulgilor de zăpadă.

Prin urmare, în prezent matematicieni din întreaga lume definesc modele pentru a simula creșterea fulgilor de nea știind că un fulg reprezintă un singur cristal de gheață care are de obicei formă de prismă hexagonală (fig. 9),

tions could be reassessed by electronic microscopy techniques (fig. 9). This time research centers of famous universities dedicate special programs to snow and snowflake crystallization studies, and especially on solving the challenging issues on modeling the crystallization process. So, presently worldwide mathematicians are using models to simulate snowflake growth knowing that a snowflake is a single crystal of ice usually having a hexagonal prism form (fig. 9) but temperature, humidity (supersaturation), impurities, pressure variations, and other variables can influence the snowflake's shape.

How? There are networked multidisciplinary scientists working at this. Some of them are making high accuracy pictures of the real snowflakes in their environment using specially designed equipments and software (fig. 10a); others are developing computer programs aiming to mimic the growth principles of real snowflakes.

After more than 400 years of wonderings and searches, mathematical models running on powerful computers can mime how snow crystals would grow (fig. 10 b-d); about the shape…it remains a mystery, yet largely unpredictable but on the frontage of crystal growing simulation in all biggest research centers. That makes us really doubtful ***when scientists are playing…***

## Bibliography

Garvey, C. (1990). *Play*. Cambridge, MA: Harvard University Press

Pidwirny, M. (2006). "Physical Properties of Water". Fundamentals of Physical Geography, 2nd Edition

www.physicalgeography.net/fundamentals/8a.html

Nakaya, Ukichiro (1954). *Snow Crystals: Natural and Artificial*. Harvard University Press. ISBN 978-0674811515.

dar pe care temperatura, umiditatea (suprasaturarea), concentrația de impurități din aer, variația de presiune și alți parametri (știuți sau nu) o pot modifica. După mai bine de 400 de ani de observații și cercetări modelele matematice care rulează pe calculatoarele performante ale sec XXI pot imita modul de creștere al cristalelor de gheață, cât despre forma acestora...ea rămâne încă un mister, fiind până în prezent greu de anticipat dar găsindu-se pe lista de priorități a programelor de simulare a celor mai mari centre de cercetare.

Această poveste a fulgului de nea ne face să fim circumspecți ***atunci când oamenii de știință se joacă…***

## Iconography

http://en.wikipedia.org/wiki/Rudolf_II,_Holy_Roman_Emperor

http://ga.water.usgs.gov/edu/waterproperties.html

www.sumanasinc.com/webcontent/animations/content/propertiesofwater/water.html

www.allstar.fiu.edu/aero/coanda.htm

people.famouswhy.com/henri_coanda/

www.romania-insider.com/wp-content/uploads/2010/09/Henri-Coanda.jpg

en.wikipedia.org/wiki/Ukichiro_Nakaya

www.estatevaults.com/bol/_Snowflake.jpg

www.its.caltech.edu/~atomic/snowcrystals/designer3/large4.jpg

http://3.bp.blogspot.com/LJZ5ArmANJQ/TRPM0n726PI/AAAAAAAAABbs/Ar0TNsbzruo/s1600/Morphologydiagram_R.jpg

http://scopeweb.mit.edu/wp-content/uploads/2011/03/800px-Snowflake_magnified_usda.jpg

www.vectr.net/absentia/images/snowflake.jpg

www.ams.org/mathimagery/dislayimage.php?album=25&pos=5

Politehnica University
of Bucharest

Bucharest, Romania
EPMagazine.ro@gmail.com

Found for you by: **Romanian Editorial Board**

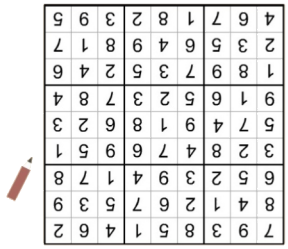
# Sudoku

Sudoku is played over a 9x9 grid, divided to 3x3 sub grids called *regions*:
The game begins with some of the grid cells already filled with numbers:
The object of Sudoku is to fill the other empty cells with numbers between 1 and 9 (1 number only in each cell) according the following guideline that a number should appear only once on each row, column and a region.

**Have Fun!**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 9 | | | | | | 6 | |
| 8 | | 1 | | | | 5 | | 9 |
| | 5 | | 3 | | 4 | | 7 | |
| | | 8 | | 7 | | 9 | | |
| | | | 9 | | 8 | | | |
| | | 6 | | 2 | | 7 | | |
| | 8 | | 7 | | 5 | | 4 | |
| 2 | | 5 | | | | 8 | | 7 |
| | 6 | | | | | | 9 | |

## Solution



Universidad Autonoma de Madrid Facultad de Medicina

Madrid, Spain
anamariaioan@yahoo.es

**Ana Maria IOAN**

# *Inducible Pluripotent Stem Cells*

## *Celulas Pluripotentes Inducidas*

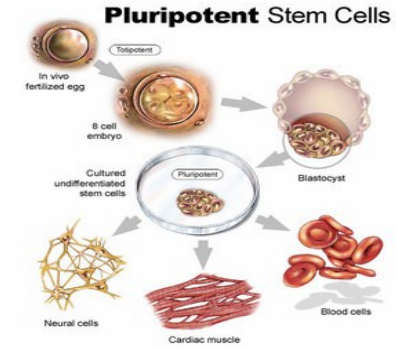



**Figure 1**

During the last decades the scientific community has made many efforts in order to develop new effective therapy techniques. Health care, transforming as early as possible scientific knowledge into solutions and augmenting life expectancy have become nowadays a primary objective. At the moment investigating with stem cells is a solution, but this type of investigations is conditioned by the society in which we live. Investigation has made possible obtaining a series of cells that have the capacity of growing and differentiating in laboratory conditions. The mentioned cells are no others than stem cells that can be derived from embryos, from fetuses or from the adult organism. Stem cells are defined as totipotent, pluripotent or multipotent cells which have the capacity of generating one or more types of differentiated cells.

Moreover, a stem cell possesses the capacity of self-renovation. There are three main sources for these cells:

- Our own body, which possesses a number of undifferentiated cells in some of its organs;
- Gonadal cells coming from aborted fetuses;
- Blastocyst phase embryos (between 5 - 14 days after its conception)

Durante las últimas décadas, se han hecho esfuerzos por desarrollar terapias novedosas para enfermedades sin tratamiento eficaz. La demanda de cuidados de salud, la exigencia de convertir, cuanto antes, el conocimiento científico en soluciones para las enfermedades incurables y la posibilidad, incluso, de aumentar la expectativa de vida, se han convertido en la actualidad en objetivos prioritarios. En este punto, la investigación con células madre representa una gran iniciativa, sin embargo dicha investigación se ve muy afectada por una serie de condicionantes en la sociedad que vivimos La investigación ha hecho posible disponer de células con la potencialidad de crecer y diferenciarse también en cultivos de laboratorio Son las células madre, que pueden derivar del embrión temprano, del feto o del organismo adulto.


**Figure 2**

Así una célula madre o stem cell se define como una célula totipotente pluripotente o multipotente (pueden originar las células de un órgano concreto en el embrión y luego también en el adulto), capaz de generar uno o más tipos de células diferenciadas y que además posee la capacidad de autorenovación. Las células madres embrionarias se pueden obtener de 3 fuentes

The main use of this type of cells is in regenerative medicine. Nevertheless the provenience of stems cells brings with it ethical problems that make their use and application more difficult. However an alternative to this problem has been encountered by the Japanese scientist Shinya Yamanaka in 2006. His discovery are the inducible pluripotent stem cells (IPS), known as IPS. These cells are a type of stem cells that acquire pluripotent qualities. They derive from differentiated cells, with no pluripotential characters, normally adult somatic cells in which the expression of certain genes is induced. In fact, the cell's DNA is reprogrammed in order to become a stem cell that can differentiate into any type of cell. The antecedent of the IPS has been found in the technique of generating adult animal clones and it is that of nuclear transfer. The first example of this technique is Dolly, the sheep. The procedure consisted in obtaining the nucleus of a mammary gland cell of an adult white sheep and eventually introducing it into a previously enucleated oocyte of a black sheep. The obtaining oocyte was transferred to the uterus of a third black sheep, which would be the

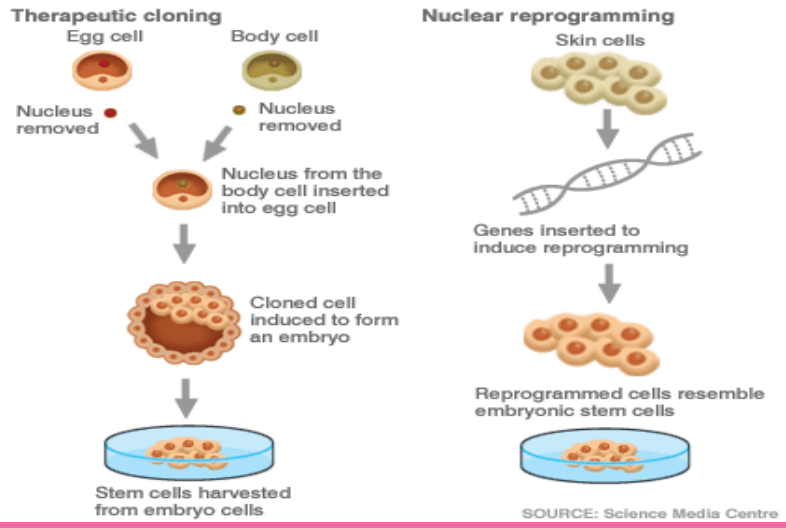



**Figure 3**

distintas:

Nuestro propio cuerpo que en determinados órganos dispone de algunas células que todavía no están completamente diferenciadas;

Las células precursoras de las gónadas de fetos abortados;

Los embriones cuando están en fase de blastocito (entre 5 y 14 días de su concepción);

El conocimiento de estas células y de las técnicas que permiten manipularlas ha posibilitado el nacimiento de una nueva terapia, la medicina regenerativa. Esta tiene como objetivo curar enfermedades debidas al funcionamiento anómalo de determinadas células, tejidos u órganos funcionales inmunológicamente compatibles con el paciente. Sin embargo, dichas células conllevan una serie de conflictos éticos los cuales dificultan su aplicación y desarrollo. Como alternativa a estas células madres embrionarias surgen las IPS, descubiertas por el japonés Shinya Yamanaka en el 2006. Las células madre inducidas, comúnmente conocidas por la abreviatura de

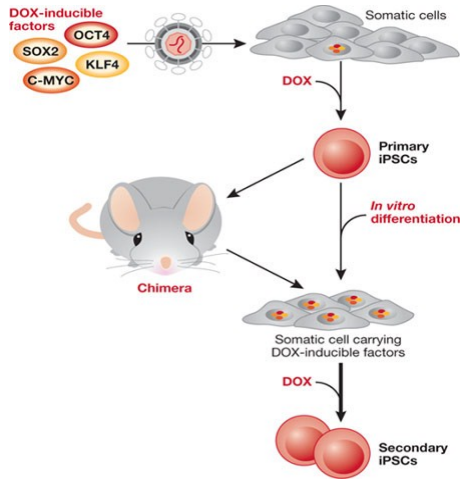



**Figure 4**

adoptive mother of the embryo. The result was that Dolly was a white sheep, a demonstration that it was a clone of a white sheep and not the natural embryo of a black sheep (1). Obtaining an IPS consist of a process which involves reprogramming the nucleus of the cell instead of eliminating it.

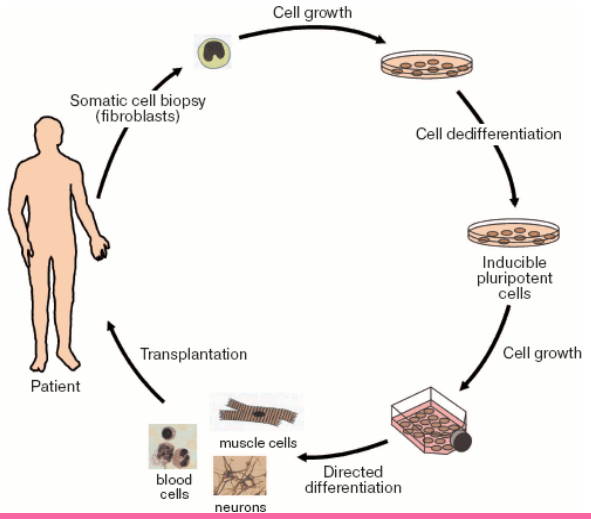



**Figure 5**

Nuclear reprogramming consists of changing the gene expression so that the cell converts to a completely different cell type. For example, by using this method, an epithelial cell can transform into a hepatocyte or a neuron. Pluripotency can be induced in these cells. The Japanese investigator was the father of this type of reprogramming using a series of transcription factors, known as Oct3/4, *Sox2*, ***c***-*Myc* and Klf4.

It was back in 2006 when for the first time a positive result was obtained in creating an induced stem cell (using mouse cells)(2).

Cellular transformation is realized using viral vectors: retrovirus (or lentivirus) that can carry the gene sequence of the four transcriptional factors. Because of the use of this type of vectors the possibility of clinical applications is limited due to the risk of mutations and cancer. Despite this fact, Yamanaka him-

sus siglas en ingles IPS, son un tipo de célula madre con características pluripotenciales que derivan artificialmente de una célula que inicialmente no era pluripotencial, por lo general una célula somática adulta, y sobre la cual se induce la expresión de ciertos genes, es decir, es una célula cuyo ADN ha sido reprogramado para comportarse como una célula madre embrionaria adquiriendo la capacidad de diferenciarse en cualquier tipo de tejido.

El antecedente de las IPS se encuentra en la manera de generar clones adultos de animales mediante la transferencia nuclear. La primera vez que se obtuvo un clon a partir de un animal adulto fue el nacimiento de la oveja Dolly, el primer mamífero clónico de la historia.

En el caso concreto de la oveja Dolly, los científicos obtuvieron un núcleo de una célula de la glándula mamaria de una oveja adulta de cara blanca, lo introdujeron dentro de un ovocito previamente enucleado de una oveja de cara negra y lo transfirieron al útero de una tercera oveja también de cara negra, una madre adoptiva donde se desarrollo el embrión.

Así, el hecho de que Dolly tenga la cara blanca sirve como garante de que esta es un clon de la oveja de cara blanca y no un hijo normal de ninguna de las otras dos ovejas (1). La reprogramación nuclear es el cambio de la expresión genética que permite que un tipo de célula se convierta en un tipo distinto. Gracias a esta técnica, es posible lograr que una célula de la piel se convierta en neurona o en una célula hepática. Estas celulas se pueden inducir para ser pluripotentes.El investigador japonés fue el padre de este tipo de reprogramación mediante el uso de una serie de factores definidos, denominados Oct3/4, *Sox2*, ***c***-*Myc* ***y*** *Klf4. Fue en 2006 cuando por primera vez consiguió obtener un resultado positivo en la obtención de una célula madre inducida (en este caso, de ratón) (2).*

Con dichas células sería posible diseñar el siguiente esquema terapéutico: de un paciente

self tried to solve the problem without using viral vectors and he managed to do so in 2008 (5).

Clinical applications may consist in the next therapeutic scheme: if a patient suffers a disease that affects one type of cells in particular, healthy cells could be taken from him and reprogrammed in order to obtain IPS that would differentiate into the affected cellular type and could replace the damaged cells repairing them. One of the great advantages that this technique brings is that it maintains the immunitary identity of the cells. For example, the IPS can be of use in the case of diagnostic probes and prenatal treatment of genetic diseases. In diagnostic probes amniotic fluid cells and cells from the chorionic villus are used. If these cells were reprogrammed to IPS they could be used in early treatment of the affected fetus. In the second place IPS could be the solution for treating type 1 diabetes, which nowadays affects an important percentage of the population. The therapy would consist in replacing b - cells. For this the IPS obtained from the same patient would differentiate into insulin producing cells. The IPS could also be the solution for cardiac and neurologic diseases.

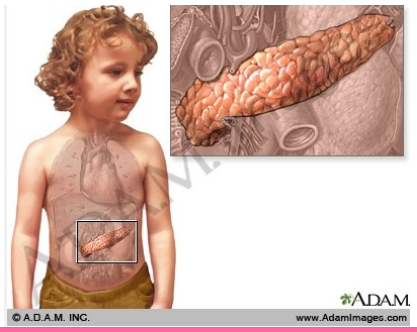



**Figure 6**

The discovery of IPS and their continuous development bring a series of advantages and inconveniences. The principal disadvantages are the prospective power of transmitting viral diseases and generate tumors (because of the use of *c-Myc* which is a known oncogene), but there are also dis-

que padeciera una enfermedad congénita o degenerativa la cual afecta principalmente a algún tipo celular, se podrían obtener células sanas que podrían ser utilizadas para obtener IPS; a partir de las IPS se derivaría, mediante diferenciación, el tipo celular dañado o en degeneración que se quisiera sustituir o reparar. La ventaja de este procedimiento es que no requiere el uso de embriones y que conserva la identidad genética de las células por lo cual no debería haber problemas de un rechazo por parte del paciente.

En estos últimos años se han realizado varias investigaciones y experimentos para aprovechar el potencial terapéutico de las células en cuestión. A continuación expondremos algunos ejemplos relevantes sobre el tema.

Se puede resaltar la aplicación de las IPS en el diagnóstico y tratamiento prenatal de enfermedades genéticas. En las pruebas de diagnóstico se utilizan células del líquido amniótico o células de muestras de vellosidades coriónicas si estas células se pueden reprogramar como IPS podrían utilizarse en el tratamiento temprano del feto afectado durante el periodo prenatal. Otra de las soluciones que aportan las IPS es el tratamiento de la diabetes de tipo 1 (T1D), la cual afecta en la actualidad a un importante porcentaje de la población.La terapia utilizada para la T1D consta en reemplazar las células b. Las IPS asegurarían una tal fuente, dado que se podrían inducir a diferenciarse a células pancreáticas productiors de insulina.

Las IPS también pordrian ser una solucion para el tratamiento de afecciones cardiologicas y neurologicas.

El descubrimiento de las células IPS y su continuo desarrollo y crecimiento que está teniendo en los últimos años, lleva consigo toda una serie de ventajas e inconvenientes, pero hay que tener esperanza y hay que proveer métodos para animar la investigación sobre este tema, que tiene una meta tan noble como salvar la vida.

advantages of ethical nature, given that these cells could be used to generate germinal cells and therefore create human beings. However, this last use would imply difficult techniques and it would be too early to talk about ethical implications.

The advantages of the IPS consist in their high genetic homogeneity, which favors their possible clinical use, given that they do not induce an immunological response. Moreover they offer the possibility of creating a personalized treatment for each patient. The IPS also provide a less expensive method, taking into account the fact that their obtaining does not imply human oocytes, hence the technique is easier. This fact brings us to the previous ethical point, which this time would cause no polemic given that the IPS are obtained in the laboratory, without the sacrifice of human embryos.

Even though not much is known about the future of the IPS we have to take into account that investigations started in 2006, which is a short period of time ago. We have to hope and we have to provide methods in order to animate and inspire investigation on this subject, which has such a noble purpose as saving human life.

## Iconography

http://protein.bio.msu.su/biokhimiya/contents/v73/full/73131438.html

www.adn.es/tecnologia/20080109/IMA-1370-YAMANAKA-SHINYA

http://technicalstudies.youngester.com/2008/08/stem-cell-milestone.html

www.adamimages.com/Diabetes---type-1---Pancreas-Illustration/PI10719/F4

www.allyouwantfree.com/images/index.php?t=stem-cell-technology

## Bibliography

(1) Nombela C. Células Madre. Madrid: Editorial Edad; 2007.

(2) Takahashi K, Yamanaka S. Induction of pluripotent stem cells from mouse embryonic and adult firoblast cultures by defined factors. Cell. 2006; 126 (4): 663-76.

(3) Yamanaka S. A fresh look at IPS cells. Cell. 2009; 137: 13-17.

(4) Takahashi K, Tanabe K, Ohnuki M, Narita M, Ichisaka T, Tomoda K, Yamanaka S. Induction of pluripotent stem cells from adult human fibroblasts by defined factors. Cell. 2007; 131 (5): 861-72.

(5) Okita K, Nakagawa M, Hyenjong H, Ichisaka T, Yamanaka S. Generation of mouse induced pluripotent stem cells without viral vectors. Science. 2008; 322 (5903): 949-53.

(6) Ye L, Chang JC, Lin C, Sun X, Yu J, Wai Kan Y. Induced pluripotent stem cells offer new approach to therapy in thallasemia and sicke cell anemia and option in prenatal diagnosis in genetic diseases. 2009; PNAS. 24 (106):9826-9830.

(7) Maehr R, Chen S, Snitow M et al. Generation of pluripotent stem cells from patients with type 1 diabetes. 2009; 37(106):15768-15773.

(8) Martinez Fernandez A, Nelson JT, Ikeda Y, Terzic A. c-MYC independent nuclear reprogramming favors cardiogenic potential of induced pluripotent stem cells. J Cardiovasc Transl Res. 2010 February 1; 3(1): 13–23.

(9) Osakada F, Takahashi M et al. In Vitro differentiation of retinal cells from human pluripotent stem cells by small-molecule induction. Journal of Cell Science 2009; 122: 3169-3179.

(10) López Moratalla N. Cuad. Bioét. XIX, 2008/2.

Politehnica University
of Bucharest

Bucharest, Romania
terzealoredana@yahoo.com

**Loredana Elena TERZEA, Stefania MOROGAN, Oana-Maria MANTA**

# *"Est Modus In Rebus": Measure – Expression of Knowledge*

## *"Est modus in rebus": Masurarea – Expresie a cunoasterii*

The technological evolution, especially after the Industrial Revolution (18-19th century), created the necessity of manufacturing interchangeable parts. This leaded producers to face one of the major problems of manufacturing, caused by the lack of unity on the measure systems.

Worldwide, where the germs of civilization emerged and evolved, also appeared the necessity of giving a measure to certain things, both on physical and philosophical way.

***Est modus in rebus*** (Latin) means that there is a proper measure in everything and the **golden mean** should always be observed.

It is really fascinating that the capability of a community to describe measure

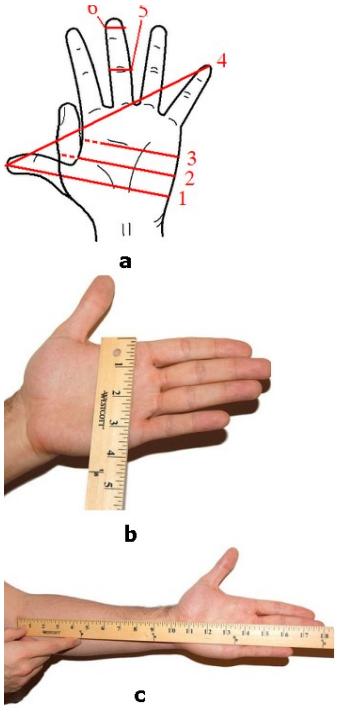



**Figure 1**
**Hand related metric units**
*Unități de lungime raportate la anatomia bratului și a palmei*

Evoluția tehnologică, dar mai ales Revoluția Industrială (sec. XVIII-XIX) au condus la necesitatea fabricării reperelor interschimbabile și au ridicat primele probleme majore din lipsa armonizării sistemelor de măsură.

Peste tot în lume, acolo unde s-au dezvoltat și au evoluat nuclee ale civilizației umane, a apărut și necesitatea de a da o măsură lucrurilor atât în plan fizic cât si filozofic- ***Est modus in rebus*** (Latin) înseamnând ***este o măsură în toate***.

Este cu adevărat fascinant modul în care capacitatea unei comunități de a descrie, măsura și caracteriza realitatea obiectivă și de a modela și abstractiza realitatea virtuală (filozofic, matematic, etc) i-au determinat însăși evoluția.

Comunitățiile izolate ale antichității și ale perioadei medievale au operat cu diverse sisteme de măsură care interacționau sporadic, exclusiv pe căile comerciale.

Deși definite pe diverse coordonate geografice primele unități de măsură relaționau elementele anatomiei umane cu obiectul de caracterizat: degetul, palma, cotul sau pasul (figura 1).

| DENUMIRE | SUBUNITATI | MOLDOVA | MUNTENIA |
|---|---|---|---|
| **Versta** | 835 stanjeni | 1.67 km | |
| **Funie** | 4prajini 12 stanjeni | 26.76 m | 24.24 m |
| **Prajina** | 3 stanjeni | 6.69 m | |
| **Stanjen** | 8 palme | 2.23 m | 1.97 m |
| **Cot** | | 66.4 cm | 63.7 cm |
| **Palma** | 10 degete | 27.875 cm | 24.625 cm |
| **Palmac** | 12 linii Md | 35 mm | 20.5 mm |
| **Deget** | 10 linii Mt | 28 mm | 25 mm |
| **Linie** | | 2.9 mm | 2.5 mm |

**Table 1: Old units in Romanian historic regions**

| Name | Subunits | Moldavia | Muntenia |
|---|---|---|---|
| **Versta** | 835 stanjeni | 1.67 km | |
| **Rope** | 4 sticks 12 iris | 26.76 m | 24.24 m |
| **Stick** | 3 iris | 6.69 m | |
| **Iris** | 8 palms | 2.23 m | 1.97 m |
| **Elbow** | | 66.4 cm | 63.7 cm |
| **Palm** | 10 fingers | 27.875 cm | 24.625 cm |
| **Palmac** | 12 lines Md | 35 mm | 20.5 mm |
| **Finger** | 10 lines Mt | 28 mm | 25 mm |
| **Line** | | 2.9 mm | 2.5 mm |

**Table 2: Old units in Ancient Greece**

| Greek Name | Equivalent | Metric System |
|---|---|---|
| **Dactylos** | The length of a finger | 0.0193 m |
| **Palaeste** | The wide of the hand | 0.0771 m |
| **Spithame** | The distance between two fingers | 12 dactili 0.2312 m |
| **Pos** | Feet | 16 dactili 0.3083 m |
| **Pehys** | Elbow | 0.4624 m |
| **Bema** | Step | 0.771 m |
| **Orgynia** | Iris | 1.85 m |

and characterize the objective reality, to design abstract issues or to seed notions of virtual reality (on philosophical and mathematical ways) induced the evolution of the society itself.

The solitary communities, from Antiquity and medieval decades, used several systems of measurement which were interacting just sporadically, exclusively on the trading ways.

Even if there were created on different geographical areas, the first units of measurement were – without exception - related to the elements of human anatomy such as: finger, palm, elbow or footstep (fig. 1).

It is useful to mention that these units did not have the same effective value and the traders knew this aspect better than anyone else, but they also knew the art of negotiation and, at the best, the art of guns. For example, the units of length were different from one territory to another even inside the same culture (table 1), but they fluctuate also across continents (table 2). Most of the geographical discoveries from the

Este de prisos să menționăm că ele nu aveau strict aceeași valoare și cel mai bine știau acest lucru negustorii care străbăteau căile comerciale ale vremii și erau fini cunoscatori ai artei negocierii, dar și ai artei armelor.

Unitățile de măsură pentru lungime, de exemplu, erau diferite de la un ținut la altul în interiorul aceleiași culturi (tabelul 1), variau de la țară la țară (tabelul 2) și de la continent la continent. Marile descoperiri geografice ale secolelor XV-XVI au fost intr-un fel precursorii Revoluției Industriale dinamizând relațiile comerciale și antrenând astfel prin pârghii economice modificarea condițiilor de producție și ale raporturilor cu forța de muncă.

Prin urmare, la sfârșitul sec. XVIII are loc o ireversibilă răsturnare de situație. Ceea ce funcționase în societățile agricole relativ nuclearizate, legate doar de punți comerciale și eventuale campanii militare,

XV-XVI centuries were a sort of forerunner for the *Industrial Revolution,* stimulating the trading relationships and the use of the economical instruments to succeed into modifying the conditions of production and the relationship with the workforce.

So, at the end of the 18th century a severe approach on the harmonization of the measurement units imposed itself. What was efficiently running in the agricultural societies, closed communities having just incidental connections through the trade routes or by the military campaigns, became useless/invalid once of a sudden. New commercial relationships and cultural interferences were taking place on a very short frame of time opening an era of knowledge, which was going to modify forever the way of perceiving the Universe.

The measurement approach, started on the most accessible way from body related units, evolving in just few centuries (once with telescope and electronically microscope inventions) and reaching the macro- and micro-size characterization of Universe. These notions have been theorized long before by philosophers, even without effective tools of describing or measuring them, thus making possible the evolution of thinking and modeling through a highest level of abstraction. Actually, in front of the increased orders from the textile industry and aimed by the wish of making order in trading relations, the French were the first who tried to erase the dysfunctions caused by the lack of a unique system of measurement, implementing the first one by the power of law in the entire France. So, on 26th of March 1791 *The Constituent National Assembly* adopted the principles of creating a ***system of measures and weights*** (***system des poids et mesures***) which was based on a unit length called **meter** *(gr.* ***Metron*** *= measure)* and being ***equal*** **with the 10th million part of Earth meridian quarter.** This definition was proposed by a


**Figure 2**
**International System of Units**
*Sistemul international de unități de măsură*

devenise dintr-o dată inoperant. Aveau loc schimburi comerciale dar și interferențe culturale și se pornește astfel într-o manieră nebănuită o adevărată aventură a cunoașterii, care avea să modifice însuși modul de percepere al Universului.

Începând de la cea mai accesibilă formă a descrierii, de la mărimile corporale, urmează să se ajungă în doar câteva secole, odata cu inventarea telescopului și a microscopului electronic, la caracterizarea macro si micro universului, noțiuni pe care filozofia le teoretizase fără a le putea descrie și măsura cu mii de ani înainte facând astfel posibilă această evoluție prin capacitatea de abstracție. Concret, în fața comenzilor tot mai mari din industria textilă și din dorința de a pune ordine în relațiile comerciale francezii sunt primii care încearcă să înlăture disfuncțiile lipsei unui sistem unic de măsurare prin implementarea unui asemenea sistem pe întreg teritoriul Franței. Astfel la 26 martie 1791 Adunarea Naţională a Constituantei a adoptat principiul constituirii unui ***sistem de măsuri şi greutăţi*** (***system des poids et mesures***) ce se baza pe o unitate de lungime: **metru** *(gr.* ***Metron*** *= măsură),* ***egală*** **cu a 10-a milioana parte a sfertului meridianului pământesc**. Definiţia aceasta a fost propusă de către o comisie numită de Academia de ştiinţe din Paris. Sistemul de unităţi nou creat în

committee called The Academy of Science from Paris. From this moment started a new stage in the history of measurement units which was going to lead to the International System of Units (fig. 2).

It is to be mentioned that SI become operable and it was implemented in many countries as an expression of their industrial development (beginning with 60's), but also like an expression of their political will. Presently most of the countries adopted SI, but there are still some big economical powers, like United States or Great Britain, on the course of adapting to it. US are operating with a limited number of elements from the International System and Great Britain is in the process of adopting SI for almost one century, aspect that is reflected also in the dynamics of units' harmonization among the Commonwealth's countries.

Franţa a fost denumit Sistemul Metric si odata cu el a început o nouă etapă în istoria unităţilor de măsură ce avea să ducă la Sistemul Internaţional de Unităţi (SI).

Este interesant de menționat ca sistemul devine operabil și este implementat de tot mai multe țări pe măsură ce nivelul lor de industrializare crește (începând din 1960), dar și ca expresie a voinței politice. În prezent cele mai multe state au adoptat SI, dar mari puteri economice precum Statele Unite ale Americii operează și în prezent doar limitat cu elemente ale SI (Sistemul Internațional); Marea Britanie este de aproape un secol în ***curs de adoptare a sistemului metric***, ceea ce se reflectă și în dinamica armonizării cu SI în fostele ei colonii. Un lucru a devenit cert însă: odată apărută și perfecționată o modalitate de caracterizare și de măsurare a unui fenomen știința și tehnologia preia controlul asupra dinamicii dezvoltării cunoașterii impulsionând toate celelalte domenii ale vieții sociale și economice.



| **Compass** *Compas* | **Quadrant** *Cvadrant* | **Vernier** | **Vernier Caliper** *Șubler* |
|---|---|---|---|

**Figure 3**

It becomes clear that through standardization it was enhanced a way of characterizing and measuring phenomena, an engine for science and technology that get the control over the dynamics knowledge development, boosting all the other domains of social and economical life.

**Knowledge is power**

What type of connection can be among the period of Chinese Han Empire (202 BC-220 AD), the cursor, the oldest wooden compass found on the archaeological remains of a Greek settlement near the coast of Italy, and the caliper of Pierre Vernier? Reviewing the history of almost two

**Cunoașterea înseamnă putere**

Ce legatură poate fi între Imperiul Han din China anilor (202 BC- 220 AD), cursor, cel mai vechi compas din lemn găsit printre vestigiile arheologice ale unei așezări grecești din apropierea țărmului Italiei, Pierre Vernier și șubler?

Trecând în revistă istoria unei perioade

**Figure 4**
**Electron microscope constructed by Ernst Ruska (1933)**
*Primul microscop electronic*

millennia it appears that a bronze tool using a slider system was used by the Chinese since the Han dynasty to calculate the days, months and years.

Instruments like compasses have been used since ancient period for measuring the distances on navigation, these being firstly made by wood (fig. 3). In 1631 the French mathematician and inventor Pierre Vernier, who was also passionate by navigation, published in Brussels a treatise on ***the construction, uses, and properties of a new mathematical quadrant***; the quadrant being the mathematical term for ¼ of a circle and also a navigation tool widely used long before the period of the *Great Geographical Discoveries*.

So, now becomes obvious how the calendar, compass, quadrant and mathematical tables joined into the instrument invented later on, in 1851, by Joseph Brown, giving a more effective use to Vernier caliper (fig. 3), an instrument able to read thousandths of an inch - because the invention didn't emerged in the area of SI but in the Imperial System of Units.

If the road toward the compass took almost two millennia, that one toward the electron microscope was only...80 years away.

In 1929 the French physicist Louis de Broglie received the Nobel Prize for Physics for his

de aproape două milenii se poate spune că instrumente din bronz care aveau cursor erau folosite de chinezi încă din vremea dinastiei Han pentru calculul zilelor, lunilor și anilor de pe parcursul anului. Pentru măsurarea distanțelor și în navigație s-au folosit multă vreme, încă din antichitate, instrumente asemănătoare compasului, confecționate mai întâi din lemn (fig. 3). În 1631 matematicianul și inventatorul francez Pierre Vernier, care a învățat științele exacte de la tatăl său, publica la Brussels un tratat despre ***construcția și proprietățile unui nou cvadrant*** (***The Construction, Uses, and Properties of a New Mathematical Quadrant***), cvadrantul fiind termenul matematic pentru ¼ dintr-un cerc, dar și un instrument de navigație utilizat pe scară largă cu mult înaintea perioadei marilor descoperiri geografice (fig. 3)

Iată cum calendarul, compasul, cvadrantul și tabelele matematice aveau să se reunească în 1851 în instrumentul inventat de americanul Joseph Brown, șublerul cu vernier (fig. 3) (vernier caliper), capabil să citească miimi dintr-un inch – pentru că invenția nu s-a produs în spațiul SI ci în Sistemul Imperial de unități de măsură.

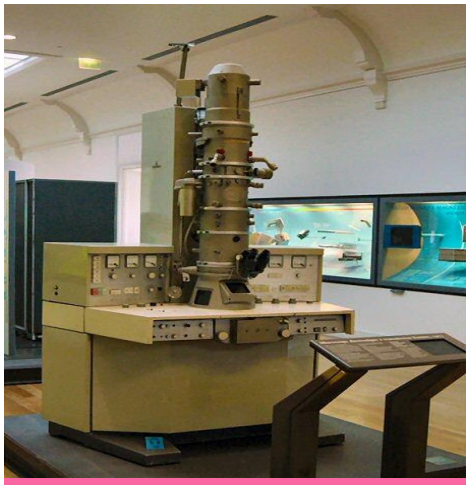


**Figure 5**
**Siemens-electron-microscope**
*Microscop electronic modern (Siemens)*

discovery on the wave nature of electron. Only two years later (1931) the German engineers Ernst Ruska and Max Knoll designed the first electron microscope able to increase the image of the objects for about 400 times (fig. 4).Currently, operating on the same principle the electron microscopes provide better resolution of about 0.2nm for a $2x10^6$ power magnification (fig. 5), while the best optical microscopes are limited by the diffraction phenomenon at a resolution around 200 nm for a magnification power of up to $2x10^3$. The fact is that after the occurrence of the electron microscopy a new field of research has been revealed. Its potential has to challenge all areas of science, opening to knowledge a universe with new properties and laws, able to redefine many of the present knowledge.

**Figure 6**
**Mili- and micro- sized applications of a DNA biochip**
*Aplicații mili- și micro- dimensionale*

Something similar happened with the knowledge at the macroscopic level that made possible the beginning of the Spatial Era otherwise than as a science anticipation scenario.

Telescope is an instrument consisting of a sequence of lenses and mirrors used to identify, observe and possibly taking photos of objects situated at large distances.

Beginning with the first observation regarding the magnifying effect of water glass lens, until the nowadays achievements on lens industry some basic optical scheme were defining the characteristics of the first instruments designed to

Dacă drumul de la compas la șubler a durat două milenii, de la șubler la microscopul electronic n-a mai fost decât un pas de...80 de ani.

În 1929 fizicianului francez Louis de Broglie primea premiul Nobel pentru fizică pentru descoperirea naturii ondulatorii a electronilor, descoperire pe care în 1931 inginerul german Ernst Ruska și colegul său Max Knoll fundamentau construcția primului microscop electronic, capabil să mărească obiectele de 400 de ori (fig. 4). În prezent, funcționând pe baza aceluiași principiu, microscopul electronic oferă o rezoluție mai bună de 0,2nm pentru o putere de mărire de $2x10^6$ (fig. 5), în timp ce microscoapele optice cele mai performante sunt limitate de difracție la rezoluții în jur de 200 nm

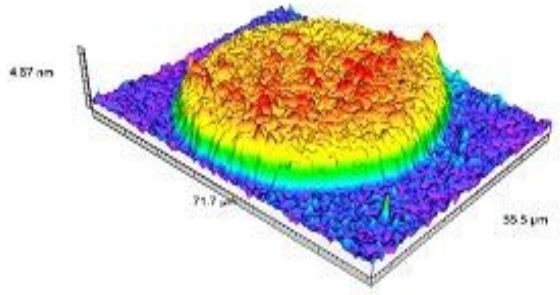


**Figure 7**
**Nanostructure application/ Image**
*Aplicații nanostructurale/ Imaginea unui biocip ADN*

pentru puteri de mărire de până la $2x10^3$. Cert este că după apariția microscopului electronic s-a dezvăluit cercetătorilor un domeniu al cărui potențial era doar intuit, un microunivers cu proprietăți și legi noi, capabil să redefinească multe dintre domeniile științei și să creeze ramuri științifice noi.

Ceva asemănător s-a produs și la nivelul cunoașterii macrouniversului.

Pornind de la efectul de lupă observat la primele lentile cu apă, până la obținerea lentilelor propriu-zise și la definirea schemei optice caracteristice primelor instrumente

increase the image of the planets and stars. Great names of Physics and Astronomy related their activity with the improvement of these tools: Galileo Galilei, Johannes Kepler, Christiaan Huygens, Isaac Newton, etc.

The large parabolic mirror design and manufacture and the glass mirror silvering process, introduced by Léon Foucault (1857)- later on replaced with more durable materials such as aluminum (1932) - made possible the astronomical space distance observations beginning with the middle of last century. Some observations and measurements were made also using radio telescopes in a wide range of wavelengths, from radio waves to gamma rays.

**Measurement – a vector of knowledge**

With the invention of caliper and other measurement means the dynamics of the innovations in the area of measuring and characterization rose so fast as only 80 years later (1939) it was experienced another major invention – the electron microscope. Then the things grow by themselves as only two decades later (1959), another Nobel laureate in physics, Richard Feynman made the historical statement: ***There is plenty of room at the bottom*** which was meant to be an invitation to explore the micro-sized universe and effectively opened the Nanotechnology era. Among the subdivisions of

capabile să mărească și să apropie imagini (1608), mari nume ale fizicii și astronomiei și-au legat activitatea de perfecționarea acesor instrumente: Galileo Galilei, Johannes Kepler, Christiaan Huygens, Isaac Newton, etc.; telescopul fiind un instrument constituit dintr-o succesiune de lentile și oglinzi utilizate pentru identificarea, observarea și eventual fotografieerea obiectelor aflate la mare distanță

Apariția și fabricarea oglinzilor parabolice de mari dimensiuni de către John Hadley, precum și procedeul de argintare a sticlei oglinzii, introdus de Léon Foucault (1857) și apoi înlocuirea procedeului cu acoperirea cu materiale mai durabile, cum este aluminiul (1932) au făcut posibile observațiile astronomice care au deschis era spațială începând de la jumătatea secolului trecut, observațiile și măsurătorile fiind făcute prin intermediul radio telescoapelor și într-o gamă largă de lungimi de undă, de la undele radio până la razele gamma.

***Figure 8***
***MWCN- Carbon***
*Nanotuburi de carbon*

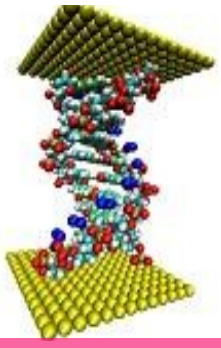


***Figure 9***
***NanotubeDNA-like nanomaterial***
*Modelarea structurii nanomaterialului*

***Figure 10***
***SEM-image of pollen***
*Polen -microscop electronic prin scanare*

**Măsurarea - vector al cunoașterii**

Inventarea șublerului și a altor mijloace de măsură și control de la sfârșitul sec. XIX și inceputul sec. XX au facut să se obțină și să se acumuleze suficiente date pentru ca în numai 80 de ani să apară o nouă invenție majoră, așa cum trebuie considerată microscopia electronică.

Dpă numai două decenii de la acest moment

meter the nanometer is $10^{-9}$ part of a meter, the prefix ***nano*** came from the Greek language, meaning ***dwarf***. So it is a ***dwarf*** that would challenge the knowledge, creating new branches of science and redefining many of the current applications (fig. 6 - 10). The evolution continues! If we are looking around everything seems to be changing, even the definition of the etalon-meter that becomes ***the 29th million part of the distance traveled by light in vacuum during a second***. Now things seem more difficult to understand, but actually their meaning is to be found in the knowledge evolution. The basic idea is that the accuracy and how they can characterize (measure, analyze, interpret) in a given time parameters of a system is the ***measure*** degree in the social evolution, technological, scientific, of the spiritual community.

## Iconography

www.britannica.com/facts/5/73537/La-Construction-l-usage-et-les-proprietes-d
thepirateking.com/historical/quadrant.htm
http://nobelprize.org/nobel_prizes/physics/laureates/1929/
http://en.wikipedia.org/wiki/File:Siemens-electron - microscope.jpghttp://en.wikipedia.org/wiki/History_of_the_telescope
http://upload.wikimedia.org/wikipedia/commons/3/3a/Sarfus.DNABiochip.jpg
www.neno-tech-views.com/?p=597
www.tekno.dk/uploadimages/articlespic_1219.jpg
www.neno-tech-views.com/
The American Heritage Dictionary of the English Language, www.answers.com/library/Dictionary#ixzz1FCxbLqj6
www.merriam-webster.com/dictionary/est+modus+in+rebus?show=0&t=1295439905
http://wow.cuc.md/?p=130
http://ro.wikipedia.org/wiki/Sistemul_anglo-saxon_de_unit%C4%83%C8%9Bi

(1959), un alt laureat al premiului Nobel pentru fizică, Richard Feynman avea să facă afirmația ***There's plenty of room at the bottom*** (Este suficient loc ceea ce însemna o invitație pentru explorarea universului microdimensional, dar semnala și deschiderea Erei Nanotehnologice. Dintre subdiviziunile metrului nanometrul reprezintă a $10^{-9}$ a parte dintr-un metru, prefixul ***nano*** provenind din limba greacă și înseamnând ***pitic***.

Este un ***pitic*** care răstoarnă concepte, crează noi ramuri ale științei și este capabil să redefinească multe dintre aplicațiile curente cu care lucrăm. Continuăm să evoluăm! Dacă privim in jurul nostru totul se schimbă, chiar si definitia metrului care a devenit **a 29-a milioana parte dintr-o secunda parcursa de lumina in vid**. Acum lucrurile par mai greu de inteles, dar de fapt intelesul lor se gaseste in substratul cunostiintelor.

Ideea de baza este aceea ca modul si precizia cu care se pot caracteriza (masura, analiza, interpreta) la un moment dat parametrii unui sistem este ***masura*** gradului de evolutie sociala, tehnologica, stiintifica, spirituala a unei comunitati.

## Bibliography

www.britannica.com/facts/5/73537/La-Construction-l-usage-et-les-proprietes-d
www.thepirateking.com/historical/quadrant.htm
http://nobelprize.org/nobel_prizes/physics/laureates/1929/
http://en.wikipedia.org/wiki/File:Siemens-electron- microscope.jpghttp://en.wikipedia.org/wiki/History_of_the_telescope
http://upload.wikimedia.org/wikipedia/commons/3/3a/Sarfus.DNABiochip.jpg
www.neno-tech-views.com/?p=597
www.tekno.dk/uploadimages/articlespic_1219.jpg
www.neno-tech-views.com/

University of the West of England

Bristol, United Kingdom
ana2.Lacatus@live.uwe.ac.uk

**Ana-Maria LACATUS**

## *Modern - innovative - green - renewable - sustainable*

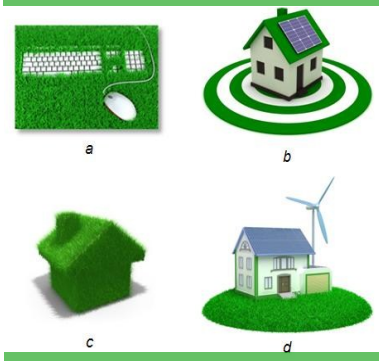



**Figure 1**

In the last few years, the word *sustainable* has been used almost in the same amount that a human being uses water day by day. All around the globe, amongst all industries and tackling all kinds of issues, *sustainability* became more than just a concept. It became a bridge, making connections between all disciplines, bringing together Politics, Economies and Technology with Ecology, Environment and Ethics (fig. 1).

In his report, ***Our Common Future***, Brundtland wrote, what now became the most common definition of ***sustainable development***. As such he defined it: ***the development that meets the needs of the present without compromising the ability of future generations to meet their own needs***. One might argue that the statement that Brundtland made is not a basis of theory whatsoever, but however it gives a solid ground for people from different industries to create their own definition based on the specificity of their knowledge background.

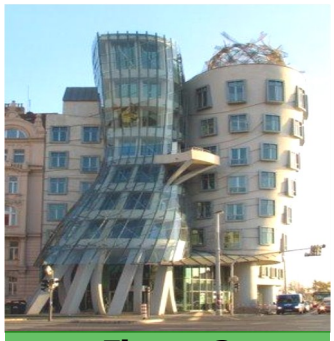


**Figure 3**

What ***sustainable development*** came to do was to develop a paradigm shift from the conventional model of development. To be more specific, the conventional model was promoting a sort of ***modernization*** around the globe. So we can't discuss about sustainability, without bringing into discussion his ancestor the ***modernization theory***. According to Pepper this theory is based on the assumption that as long as the society becomes more specialized and differentiated, it will become more *modern* and *innovative*. This means up dated technology tools, urbanization, highly competitive markets and so on (fig. 2, 3).

The key issue of sustainable development is creating an environmental model that promotes not just the idea of protecting the nature, but most of all aims at developing a self awareness of people in order to make them more environmental friendly (Baker S., 2006) Ekins in his book ***Economic Growth and Environmental Sustainability***, was underling the main pillars on which sustainable development stands. As he acknowledged, these pillars are the ***social*** one, concerned on the human interactions, values and norms, the ***economic*** one addressing the scarcity of resources and how to make the best out of them and the ***ecological*** one, which is a mixture of the former ones, and their impact on the environment and the resources it holds (fig.4,5). The importance of these pillars lies in the fact that they are not standing on. However in ***The Universal Declaration of Cultura Diversty*** (UNESCO, 2001), was strongly argued that ***cultural diversity is as nec-***

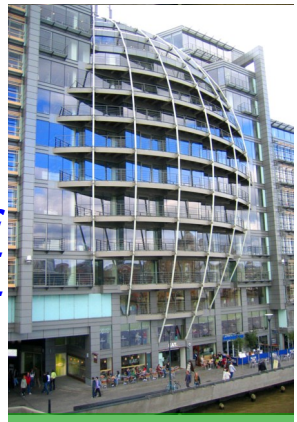


**Figure 2**

Figure 4

***essary for humankind as biodiversity is for nature*** and thus a new pillar, namely ***culture*** was added to the three existing ones. As such we can argue that sustainable development is not a well defined theory, but it develops and matures over time, along with people changing their attitudes and believes and embracing more this concept. Sustainable development is not dependent on one place and one industry, but it runs around all of them interlinking them, making them work together driven by the same scope: a better outcome, a better world, a more responsible and respectful way of treating ***Mother Nature***.

**How is the construction industry responding to the subject matter?**

The construction industry is just one of the many industries that experienced lots of changes together with associated benefits when it comes to sustainability.

The spread of the sustainability concept incentivized construction ***players*** to come up with new solutions that were ready to promote a better understanding of the needs of the environment and to develop at the same time innovative solutions in the building industry. The emphasis here is not only on the construction materials that were improved to deliver a more ***eco*** house but also the exploitation of the gifts that *Mother Nature* provides, which resulted in new energy-efficient solutions that modernized the entire industry. *Integrated solutions* such as *ground-heat* and *under floor heating* systems, huge *sites of windmills* or *solar panels* are all aimed at designing an *ecological friendly way of living*. And whilst living means building, than solutions that use these types of energy and heat generators became a must. Either generating energy using the solar panels placed on the roof of the building or windmills near to it, or using solutions such as under floor heating, systems for heating and cooling the walls with the use of under ground generated heat, the construction in itself became more than just a simple project (fig. 7), it became an *integrated project*, with a strong emphasis on the *sustainable development*. The benefits that arose from this way of designing were not tackling just the modernization issues, but they offered the premises to reduce the long term costs of the building's maintenance. One might argue that the initial costs of building such a ***futuristic*** house are high, but thinking on the long run, the benefits exceed the efforts, and given also the continuous progress that is done in the matter, the costs are only going to drop in the next few years.

Figure 5

Figure 6

**Dealing with *sustainability*: the UK case study**

However even though, from what was previously mentioned, solutions do exist, it was really hard to implement it in the brains


**Figure 7**

of the developers who were interested more in short term results. They can't argue however that a single little house in an area won't make the difference. This is where the government had a strong point in the promotion of sustainable construction. Large government initiatives were launched, incentives and penalties were introduced and thus developers had to consider the environmental issues over their immediate benefits (Langston and Ding, 2001).

The *Sustainability Agenda*, known as the *Agenda 21*, was a strong and massive *initiative of the United Nations* aimed at increasing the awareness in the sectors, that a need is necessary, to shift from the old way of doing business and asking the sectors to interact between themselves as they are all exchanging information in a sustainable development, and to integrate into their processes the environmental issues. Moreover it recognized the major impact that the public sector can have over the implementation of such things.

The UK was from the first who responded to the Agenda 21 requirements and it drafted its own sustainable development strategy in 1994.This was followed in 2000 by a gathering of construction documents concerning the key actions that have to be undertaken with regard to its policy in order to incentivize the implementation of more sustainable procedures in the industry.

**Figure 8**

Other initiatives were ***The Strategy for Sustainable Construction*** which promoted a sort of assurance from the part of the industry that it will *reduce its carbon footprint* as well as the *use of natural resources*. This report was followed the next year by a progress report in order to underline the progress that has been made as well as to increase the awareness on the barriers that were still to overcome.

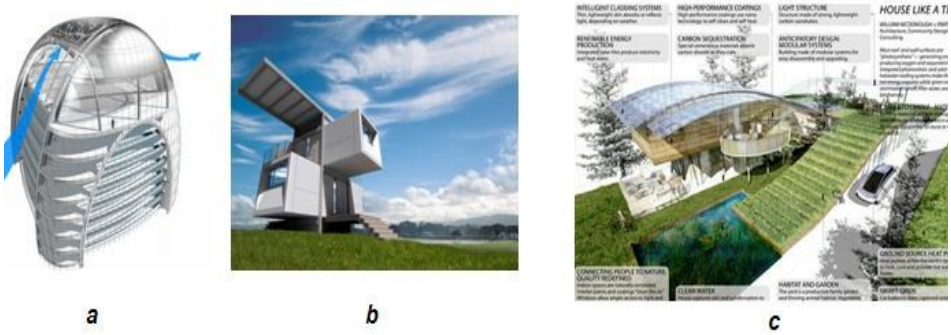



**Figure 9**

**What makes the buildings sustainable?**

What *makes* the buildings sustainable? We do! What *keeps* them sustainable? We do!

So, who *needs to be* sustainable after all? The answer is obvious: we do!!

Having said that it is very clear that the first change has to be done on the way individuals think on sustainability. However, many times people tend to see this issue more as a responsibility rather than a way in which they will benefit on the long run (fig. 8). It is the same approach with the developers that are more interested in the short term results. This is why people have to be treated the same, and incentivisation is a good driven force for human beings.

Universities especially promote this type of ***learning*** when it comes to their accommodations. Initiatives such as ***switch off competitions***, or ***electricity saving blocks or courts*** create actual competitions amongst students, who learn from an early age that being *environmentally responsible* means having benefits.

To conclude, the theory already exists, the efforts are being made, the industries respond prompt to sustainability issues, so it is just a matter of time until we will all be aware of the benefits as well as the consequences of not acting in a sustainable manner.

## Bibliography

Brudland, H.(1987) Our Common Future, Oxford University Press, Oxford

Pepper, D. (1996) Modern Environmentalism: An Introduction, Rutledge, London

Baker, S. (2006) Sustainable Development, Rutledge, London

Ekins, P. (2000) Economic Growth and Environmental Sustainability: The Prospects for Green Growth, Rutledge, London

UNESCO (2010)The Universal Declaration on Cultural Diversity [online]. Available from: http://unesdoc.unesco.org/images/0012/001271/127160m.pdf, Last Accessed 16.01.2011

Adams, W.M. (2009) Green Development: Environment and Sustainability in a developing World, Third Edition, Rutledge, London

United Nations (2010), Agenda 21[online] Available from: www.un.org/esa/dsd/agenda21/, Last Accessed 20.01.2011

HM Government (2008) The Strategy for Sustainable Construction [online] Available from: www.berr.gov.uk/files/file46535.pdf last Accessed: 21.01.2011

HM Government (2009) strategy for Sustainable Construction- Progress Report [online] Available from: www.berr.gov.uk/files/file52843.pdf Last Accessed: 21.01.2011

DETR-Environment, Transport, Regions (2000) Building a better Quality of Life [online] Available from: www.berr.gov.uk/files/file13547.pdf Last Accessed: 21.01.2011

Langston and Ding (2001) Sustainable Practices in the Built Environment, Second Edition, Butterworth Heinemann

## Iconography

http://funnyartpictures.com/01funny-pictures-art/fun-images/modern-architecture05.jpg

www.arrakeen.ch/dubai/220%20%20modern%20architecture.jpg

http://2.bp.blogspot.com/_1wHfU1IM-UE/SQoMRb90v6I/AAAAAAAAAe8/Okf3MmGb5q8/s400/New%2Bmodern%2Barchitecture%2Bbuilding2.jpg

thevividedge.com/wp-content/uploads/2010/05/5-green-building-materials-2.jpg

www.bottomlinerecycling.com/wp-content/uploads/2010/10/green_home.jpg

greenspacencr.org/img/iStock_000004249190Small_green_apt_model.gif

www.goinggreen-athome.com/image-files/green-building-materials-2.jpg

http://blog.turbotax.intuit.com/wp-content/uploads/2009/11/Energy-Efficient-House2.jpg

www.greentuan.com/wp-content/uploads/2010/12/energy-efficient-house-picture.jpg

http://hoklife.com/wp-content/uploads/2008/12/clean-technology-tower-concept-to-utilize-wind-and-solar-power_69.jpg

www.treehugger.com/mcdonough-wsj.jpg

http://img.dailymail.co.uk/i/pix/2008/04_04/orchid3L2404_800x534.jpg

www.globalconstructionwatch.com/wp-content/uploads/2008/04/zerohouse.jpg

www.colorcoat-online.com/blog/wp-content/uploads/2010/09/Sustainable-housing.jpg

http://sustainabilityninja.com/wp-content/uploads/2008/11/feature-images/sustainable-technology-gadgets.jpg

Politehnica University
of Bucharest

Bucharest, Romania
badutalex.n@gmail.com

**Alexandru-Nicolae BADUT, Daniela-Ionela SANT, Dumitru-Mihai CALIN**

# *What waste really means?*

## *Ce inseamna de fapt deseu?*

Waste is the material result from a technological process of obtaining material products or services. In other words ***waste*** is the ***useless*** result from the processing of raw materials.

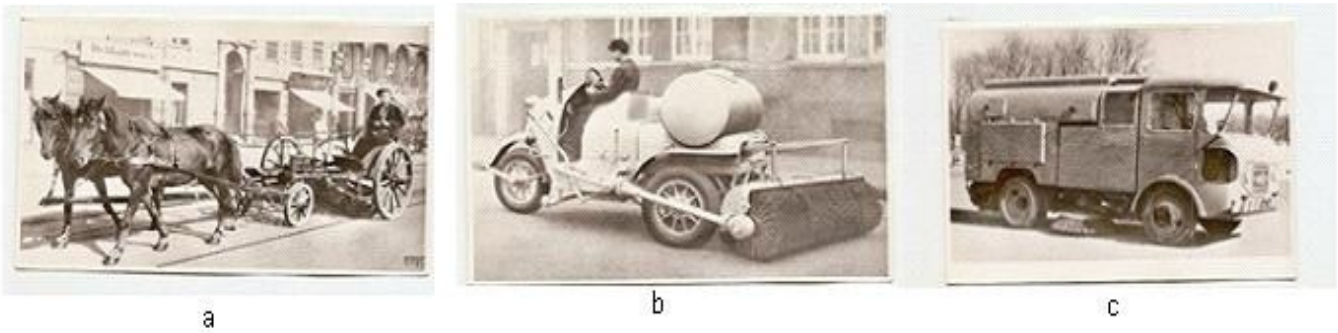
Firstly appeared as the municipal dump in the city of Athens, around 400 BC, the precursors of future health service become the first community services provided. That time employees were gathering the trash from streets and store it into containers. Later, during Middle Ages in England the Parliament issued a law that made compulsory to leave the garbage in special places.The first law against throwing waste on the streets is dated (1657) in New Amsterdam (nowadays Manhattan).

Deşeul este materia inutilizabila rezultata in urma unui proces tehnologic de obtinere de produse materiale sau servicii.

Mai intai au aparut precursorii serviciilor publice in Atena anilor 400 i.e.n. Ceva mai târziu, în timpul Evului Mediu în Anglia, Parlamentul a emis o lege care a făcut obligatorie depozitarea gunoiului în locuri special amenajate.

Prima lege împotriva aruncarii deseurilor pe străzi a aparut (1657) în New Amsterdam (Manhattan-ul din zilele noastre).

O scurta clasificare a deseurilor ar include *deseul municipal* (din gospodarie sau comercial) care reprezinta aproximativ 14% din cantitatea totala de gunoaie si *deseurile* industriale, acestea insumand, spre exemplu,



a b c

**Figure 1 Evolution of trash collecting equipment**

A brief classification of waste would include municipal waste (household and commercial), which represent about 14% of the entire amount of waste and industrial waste, e.g. these summarized 33 million tones generated in 1998 in EU.

During the construction processes, either for buildings or for infrastructure targets (road construction and maintenance) may result different types of waste which represent

33 milioane de tone generate in UE in anul 1998. În timpul proceselor de construcţie, fie pentru clădiri fie pentru obiective de infrastructură (construcţia şi întreţinerea drumurilor) pot rezultata diferite tipuri de deşeuri, care reprezintă 25% din totalul deşeurilor generate în UE. Acesta este stocat în depozitele de deşeuri speciale şi, mai târziu, prin prelucrarea prin incinerare, se obtine o rată medie de reciclare de 80%.

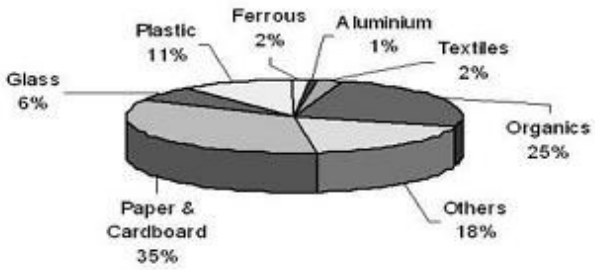



**Figure 2**

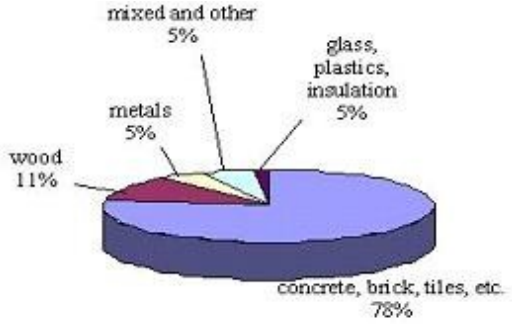



**Figure 3**

sent 25% of all the waste generated in the EU. This is stored on special landfills and later on processed by incineration, obtaining an average recycling rate of 80%. A significant source of waste is generated by the disposal of used electronics and electrical equipments, as final processing products of mining, and agriculture.

O sursă importantă de deşeuri este generată scoaterea din uz a echipamentelor electrice şi electronice, ca prelucrare a produselor finale de minerit şi agricultura. Selecţia deşeurilor constă în stocarea lor în containere speciale de colectare şi reciclare. Prin reciclarea înţelegem colectarea, separarea şi prelucrarea principalelor componente ale gunoaielor cu scopul transformării lor în produse utile. S-a dovedit că cele mai multe din materialele provenite de la ceea ce noi considerăm ca fiind deşeuri sau gunoaie pot face obiectul unui proces de reciclare cu diferite eficienţe energetice.

| Type of waste | Equivalent energy – product equivalent through recycling processes | Repeatability |
|---|---|---|
| 1 ton of glass | 1.2 tons of raw material | it can be recycled indefinitely without losing quality |
| 1 ton plastic | 700-800 kg crude oil | |
| 10 PET | manufacture of a shirt /1 meter carpet | |
| 50 PET | sweater | |

**Table 1 Waste – Energy potential**

The selection of waste consists on the storage of it on special containers for collecting and recycling. By recycling we understand the collection, separation and processing of the main components of garbage for endeavor their transformation into useful products. It has been proven that most of the materials from what we consider *waste* or *garbage* may be the subject of a recycling process with different energetic efficiencies.

So, some data can become useful information regarding the recycling process (table1, fig. 4).

Deci, unele date pot deveni informaţii utile în ceea ce priveşte procesul de reciclare (tabelul 1, fig. 4).

Pentru a imprima un ziar cunoscut e nevoie de aproximativ 300 $m^3$ de lemn, adica aproximativ 1500 de copaci de 50 de ani. Între timp, pentru producerea a 700 pungi de

**Figure 4**

To print a widely known newspaper takes about 300 $m^3$ of timber, meaning about 1,500 trees of 50 years old. Meanwhile, for the production of 700 paper bags it takes one 15 years old tree meaning that every ton of recycled paper may save 17 trees.

Because related data are giving more weight to words, it is relevant that recycling a single PET we can save enough energy to light a bulb for 6 hours continuously.

One effective method of processing the selected and deposited waste is the incineration, having as outcomes heat delivered as vapors or hot gases and ash. Through this method it can be burned waste on both solid and liquid state. The incineration power-plant is equipped with special ovens having either direct push feeder or overturned ones. These furnaces can burn waste with low caloric value of about 10 MJ/kg.

On figure 5 is the process-map representation of an incineration power-plant with a rotary kiln. Co-incineration – ***the joint incineration of hazardous waste, in any form*** becomes widely known. To achieve an effective recycling process the pre-selection of the waste is compulsory. Some spectacular types of recycling refers to the beer cans that allow to recycle aluminum; spray cans that allow the recovery other metals; paper recycling from food packaging, newspapers and magazines. The recycling process begins in warehouses by efficiently sorting the material

hârtie este nevoie de un copac vechi de 15 ani în sensul că fiecare tona de hartie reciclata poate salva 17 copaci. Deoarece datele dau mai mare greutate cuvintelor, este relevant faptul că s-a determinat ca prin reciclarea unui singur PET se poate economisi suficientă energie pentru functionarea continua a unui bec timp de 6 ore.

O metodă eficientă de prelucrare a deşeurilor selectate si depozitate este incinerarea, proces in urma caruia se obtine căldură în stare de vapori sau gaze fierbinţi şi cenuşă. Prin această metodă se pot arde deşeuri atat in stare solida cat şi lichida. Uzinele de incinerare sunt echipate cu cuptoare speciale, cu alimentare orizontala sau verticala. Aceste cuptoare pot arde si deşeurile cu valoare calorică redusă, de aproximativ 10 MJ/kg. In figura 5 este reprezentat procesul de incinerare dintr-o instalatie cu cuptor rotativ. **Co-incinerarea** - ***incinerarea deşeurilor periculoase, în orice formă*** incepe sa cunoasca o larga raspandire. Pentru a realiza un proces de reciclare eficient, pre-selectarea deşeurilor este obligatorie. Exista procedee specifice pentru recuperarea aluminiului, reciclarea incluzand dozele de bauturi ambalate sub presiune; cutii de spray care permit recuperarea de alte metale; reciclarea hârtiei de la ambalajul alimentelor, ziare şi reviste. Procesul de reciclare incepe in depozite prin sortarea eficienta a materialelor (fig.6).

Din procesul de selecţie a deşeurilor pot fi obţinute materiale biodegradabile (organice, din deşeuri menajere semi-lichide), prin a

1 - rotating combustion chamber
2 – Lower
3 – Top
4 - Lighter and maintenance of the flame device
5 - Primary air supply
6 - Automatic burner ash
7 - Ash Room
8 - Device for rotating oven
9 - Food Waste
10 - Waste liquid, pasty, solid
11 - ash disposal device
12 - Tail gas for post-combustion chamber

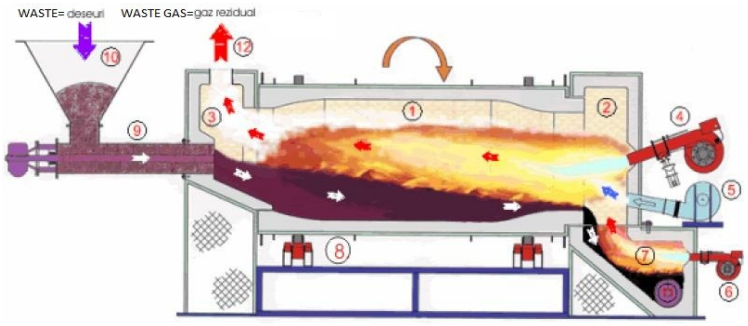



**Figure 5**

(fig. 6). From the selection process of waste can be obtained biodegradable materials (organic, from semi-liquid household waste) through whose fermentation on special reactors biogases can be generated and also a secondary solid product fertilizer type for agriculture.The biogas can be used to generate heat energy having a caloric power of 20-25 MJ/kg.

cărui fermentaţie in reactoare speciale poate fi generat biogaz şi, de asemenea, un al doilea tip îngrăşământ solid pentru agricultură. Biogazul poate fi utilizat pentru a genera energie cu o putere calorica de 20-25 MJ/kg. Acesta este transformat in uzine termice, pentru a putea fi utilizat in gospodarii sau ca sursa primara de energie asistand functionarea turbinelor din microcentralele eoliene.

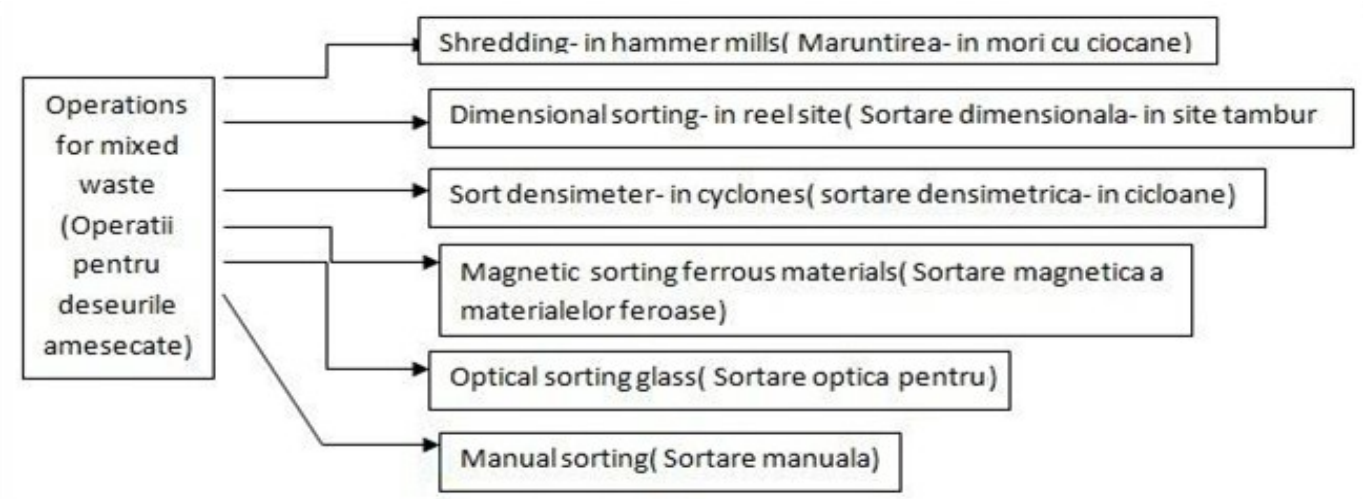



**Figure 6**

It can be burnt in thermal power-plants, for house hold applications or as primary energy source for turning on turbines on micro- power -plants. Consequently, manure is far from

Prin urmare, gunoiul este departe de a fi considerat inutil, iar cantitatile enorme de deşeuri depozitate în apropierea marilor aglomerări urbane oferă un potenţial


Figure 7

Figure 8

useless trash and the enormous amounts of waste deposited in the vicinity of large urban agglomerations offer significant potential of energy sources, next to renewable energy, for future integrated energy systems.

## Bibliography

1.Ungureanu, Corneliu (2006). *Gestionarea integrată a deşeurilor municipale*. Timişoara: Editura *Politehnica*. ISBN 973-625-386-4.
2.Manual privind activităţile specifice din domeniul gestiunii deşeurilor municipale. ProjektPartner International Services, Departamentul de Salubritate din Göttingen, Primăria Municipiului Râmnicu Vâlcea. www.gestiuneadeseurilor.ro/. Accesat la 6 septembrie 2008.
3.deseuri-online.ro/new/download/Tratarетermica.pdf
4.www.twinning-waste-bacau.ro/waste-1/despre-deseuri/cateva-informatii-despre-diferotele-tipuri-de-deseuri/#municipal
5.www.targujiu.ro/portal/gorj/tgjiu/portal.nsf/0/AD963E1A097DEFFD42257633002B9BD8/$FILE/CP_August%202010.pdf
6.http://glossary.ro.eea.europa.eu/terminology/concept_html?term=coincinerare

semnificativ de surse de energie, alaturi de energia regenerabilă, pentru viitoarele sisteme integrate de energie.

## Iconography

Figure 1: www.retim.ro/istoric.php
Figure 2: www.twinning-waste-bacau.ro/waste-1/despre-deseuri/cateva-informatii-despre-diferotele-tipuri-de-deseuri/#municipal
Figure 3: www.twinning-waste-bacau.ro/waste-1/despre-deseuri/cateva-informatii-despre-diferotele-tipuri-de-deseuri/#municipal
Figure 4: www.hotgift.ro/cms/images/produse/thumbMediu_sd3x50tricou%20simplu.jpg; www.sunnyday.ro/products_pictures/pulover-college-negru-275.jpg; www.covoare-manuale.vcc.ro/images/Covor-16.jpg
Figure 5: www.deseuri-online.ro/new/download/Tratarетermica.pdf
Figure 6: Badut Alexandru-Nicolae, Sfant Daniela-Ionela, Calin Dumitru-Mihai
Figure 7: www.jurnal.tvsatrm.ro/wp-content/uploads/2010/11/GUNOI-MAI-SCUMP.jpg
Figure 8: www.bzf.ro/wp-content/uploads/2009/06/groapa-gunoi-saci.jpg

Politehnica University
of Bucharest

GE

Bucharest, Romania
ispas_andreea89@yahoo.com

**Andreea ISPAS, Alexandru BORCESCU**

# *To be or not to be... renewable: fuel cells*

## *A fi sau a nu fi... sursa regeneragila: pila de combustie*

Being student nowadays is definitely more complicated than centuries ago!

For instance imagine us going backward not a century, but only 60 years ago, and having to find out data about Fuel Cells. It would pretty simple: course textbooks on the campus libraries –meaning a limited amount of searchable resources –then, few more data in encyclopedias and ***that is***.

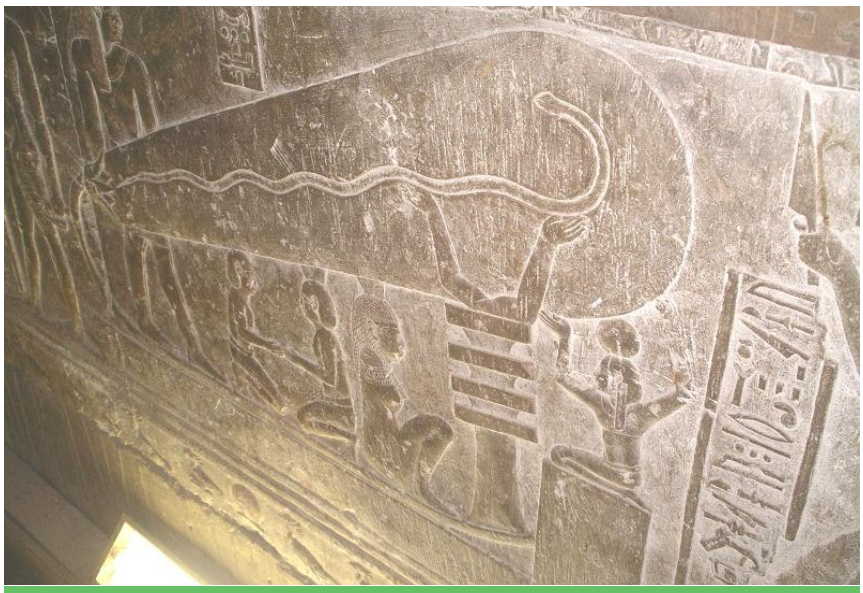


**Figure 1**

Although presently, even worldwide data stays at our fingertips through laptops and internet, we are accessing virtually infinite resources so we have to face huge filtering, organizing and revealing issues during the learning process itself.

If you will search for the definition of *Fuel Cell*, for instance, you will reach the performance of having about 404,000 results in only 0.13 seconds. Almost all are saying the same:

***A fuel cell is an electrochemical cell that derives its energy from combustible substances (hydrogen, methane, propane, methanol, diesel fuel or gasoline). The most widely discussed type is the hydrogen fuel cell, in which***

A fi student in ziua de azi este cu siguranta mult mai complicat decat in urma cu cateva secole! De exemplu, sa ne imaginam cum ar fi fost nu cu secole in urma, ci doar acum 60 ani, daca am fi vrut sa aflam mai multe despre pilele de combustie.

Relativ simplu: cartile din biblioteca campusului – insemnand un numar limitat de surse de informare – apoi, in plus cateva informatii din enciclopedii si ***asta este***.

Cu toate ca in prezent, date din toata lumea sunt disponibile prin intermediul internetului si se pot accesa virtual resurse infinite, avem de rezolvat problema filtrarii, organizarii si intelegerii datelor selectate, procesul de cunoastere devenind mult mai solicitant.

Daca vom cauta definitia *pilelor de combustie*, de exemplu, vom obtine aproximativ 404,000 de rezultate in doar 0.13 secunde. Aproape toate enuntand:

***Pila de combustie este o celula electrochimica care isi obtine energia din substantele combustibile (hidrogen, metan, propan, metanol, combustibili diesel sau benzina). Cea mai intens cunoscuta este pila pe baza de hidro-***

***energy is obtained from the oxidation of hydrogen and its only byproducts are water and a small amount of nitrous oxide, if air is used as the oxidizer.***

Once more, according with one of the many definitions: ***Renewable energy is any energy resource that is naturally regenerated over a short time scale and derived directly from the sun (such as thermal, photochemical, and photoelectric), indirectly from the sun (such as wind, hydropower, and photosynthetic energy stored in biomass), or from other natural movements and mechanisms of the environment (such as geothermal and tidal energy). Renewable energy does not include energy resources derived from fossil fuels, waste products from fossil sources, or waste products from inorganic sources.***

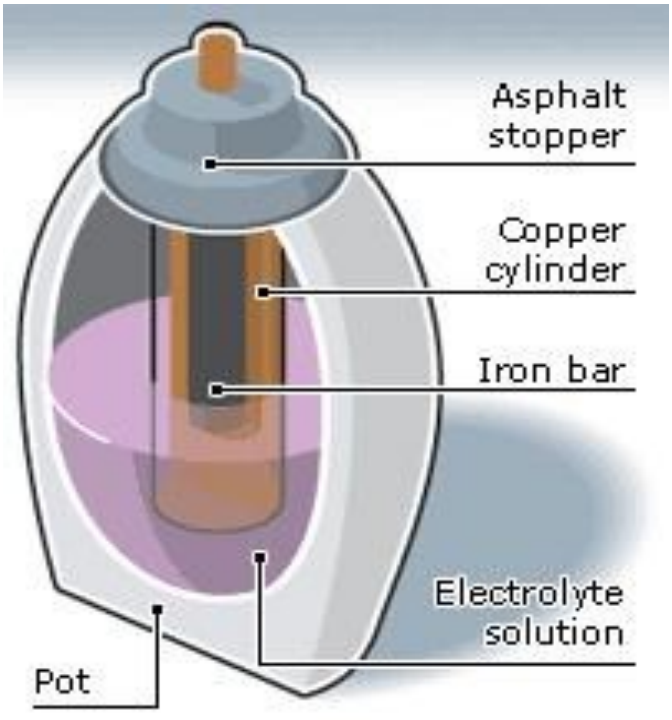



**Figure 2b**

***gen a carei energie este obtinuta din oxidarea hidrogenului, iar singurii produsi sunt apa si o cantitate mica de oxid de azot, in cazul in care se foloseste aerul ca oxidant.***

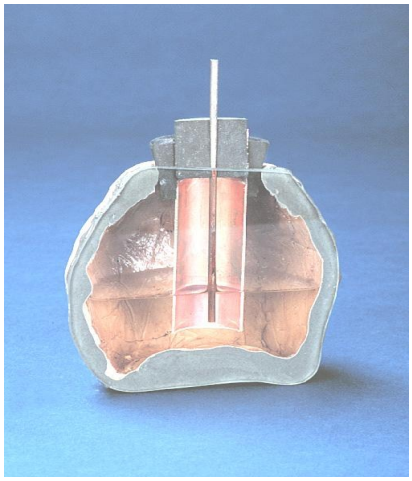


**Figure 2a**

In plus, conform uneia din multele definitii: **Energie regenerabila este orice resursa energetica capabila sa se regenereze natural intr-un interval scurt de timp fie prin actiunea directa a soarelui (cum ar fi energia termala, fotochimica si fotoelectrica) sau indirect (energia eoliana, hidroenergia si energia fotosintetica stocata in biomasa), sau din alte miscari naturale si mecanisme ale mediului (precum energia geotermala si energia mareelor). Energiile regenerabile nu includ resurse energetice provenind din combustibilii fosili, produse de deseuri din surse fosile sau din surse anorganice.**

Deci, evident *celulele electrochimice nu reprezinta o sursa energetica regenerabila*, chiar daca sunt surse energetice nepoluante si de lunga durata.

Se considera ca acestea au fost concepute de cercetatorul german, Christian Schoenbein, la mijlocul secolului al 19 lea.

In ciuda acestei perceptii publice primele documente care fac referire la ***lampi care ard continuu*** dateaza inca din Evul Mediu, pe baza descoperirilor facute in vechile morminte care erau inca luminate in interior... dupa cateva mii de ani.

So obviously, electrochemical cells are not renewable sources, even if they are clean, long lasting energy sources.

It is considered that they have been originally conceived by a German scientist, Christian Schoenbein, in the middle of the 19th century.

Despite this public perception the first records referring to ***ever burning lamps*** goes back to the Middle Ages discoveries made on ancient thumbs that were found lightened inside after…few thousand years.

More recently, at the end of 80`s, astonishing discoveries made in Egypt at the Temple of Isis shown that electricity is not so modern as we thought before (fig. 1).

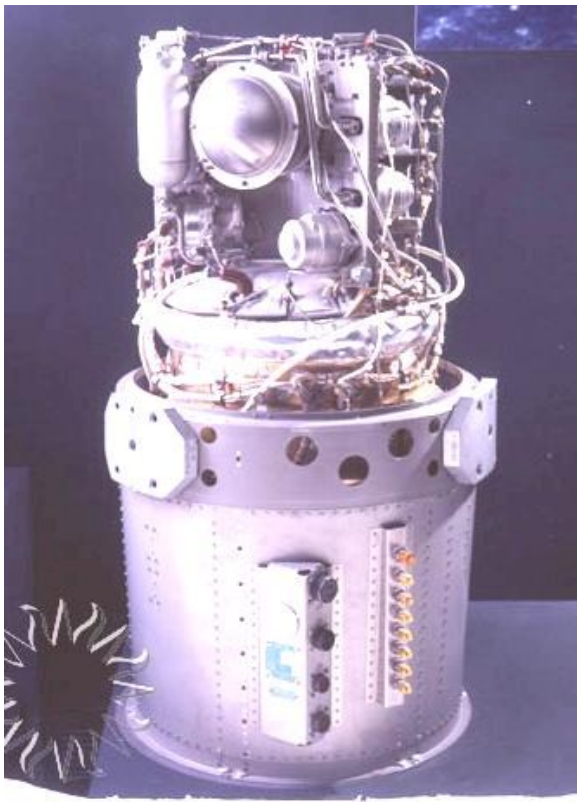


**Figure 3**

To puzzle us even more at the end of 90` archeological excavations made in Iraq shown that even the principle of functional fuel cell dates from ancient times (fig. 2 a, b) The Bagdad battery is very old, about 2000 years. The jar has been discovered in Khujut Rabu and is composed with a stopper made of asphalt.

It is not known for sure the exact use of the jar, but it is presumed it was used as a battery.

A fuel cell does not exhaust its fuel. A method of recharging the fuel cell is a tank or external supply of fuel

If you combine the cell is series or in parallel they can supply larger amount of energy

Fuel cells have been used in the space

Mai recent,la sfarsitul anilor 80, descoperiri uimitoare au fost facute in Egipt la Tempul lui Isis, sugerand ca electricitatea nu este atat de moderna cum se credea (fig. 1).

Pentru a ne incurca si mai mult la sfarsitul anilor 90 excavatii arheologice facute in Irak au aratat ca pana si principiul functionarii pilelor de combustie dateaza din cele mai vechi timpuri. (fig. 2 a,b)

Bateria descoperita la Bagdad are aproximativ 2000 de ani. Vasul a fost descoperit in Khujut Rabu si are un dop din asfalt. Nu se cunoaste exact modul de utilizare a acestui vas, dar se presupune a se fi folosit drept baterie. O pila de combustie nu isi epuizeaza niciodata combustibilul. O metoda de reincarcare a celulei este fie un rezervor fie o sursa externa de combustibil. Daca pilele se leaga in serie sau in paralel acestea pot produce o cantitate mai mare de energie.

Pile de combustie au fost folosite isi in misiunile spatiale americane din anii 60.

Celulele noi si moderne pot produce pana la 200 kW in cazul automobilelor sau al vehiculelor spatiale care sunt echipate cu acestea.

In contextul lansarii satelitului Sputnik (1958) si a dorintei agentiei NASA de a recupera decalajul fata de sovietici, pila de combustie Bacon, ce nu avea piese in miscare si cu o putere specifica si energie

missions of the Americans in 60`s

The new and modern fuel cell can provide up to 200 kW at the cars, trucks and space vehicles that are equipped with it.

specifica de 2-3 ori mai mari decat alte surse deschide drumul dezvoltarii pe scara larga a pilelor de combustie.

In anul 1965 pentru capsula spatiala Gemini V s-a utilizat o pila $H_2/O_2$ cu electrod polimer solid,iar pentru programul Apollo a fost folosita o pila $H_2/O_2$ alcalina presurizata.

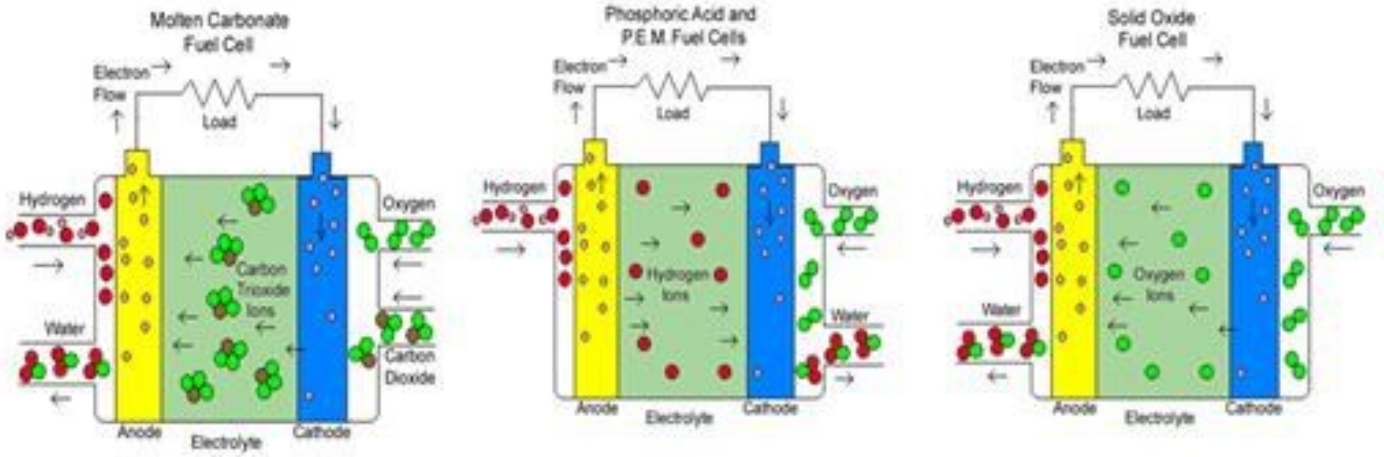



**Figure 4**

If at the beginning fuel cells have been used in space missions, later in the oil crisis, have found applicability in different areas such as vehicles. On a large scale vehicles use internal combustion engine uses petroleum hydrocarbons as fuel. Though this type of propulsion polluting and has limited resources problems related to oil. In the context of launching Sputnik (1958) and NASA's desire to catch up to the Soviets, Bacon fuel cell, which had no moving parts and a specific power and specific energy 2-3 times higher than other sources paves the way for large-scale development of fuel cell.

In 1965, the Gemini V space capsule used the $H_2/O_2$ cell with solid polymer electrode and for the Apollo program was used a $H_2/O_2$ pressurized alkaline cell. There are several criteria by which is made the classification of fuel cells:

***After the type of fuel***

using gaseous fuel
using liquid fuel
using solid fuel

***Dupa tipul combustibilului***

pile cu combustibili gazosi
pile cu combustibili lichizi
pile cu combustibili solizi

***Dupa tipul electrolitului***

pile cu electolit lichid (AFC - Alkaline Fuel Cell, MCFC - Molten Carbonate Fuel Cell, PAFC - Phosphoric Acid Fuel Cell)

pile cu electrolit solid (PEMFC - Polymer Electrolyte Fuel Cell, SOFC - Solid Oxide Fuel Cell)

***Dupa temperatura de functionare***

pile de temperaturi joase (functioneaza intre 20-80 °C)

pile de temperaturi medii (intre 200-300 °C)

pile de temperaturi inalte (400-800 °C)

***Dupa modul de consum al combustibilului***

**Figure 5**

***After the type of electrolyte***

liquid electrolyte (AFC - Alkaline Fuel Cell,

MCFC - Molten Carbonate Fuel Cell (fig. 4a),

PAFC - Phosphoric Acid Fuel Cell (fig. 4b)

solid electrolyte (PEMFC - Polymer Electrolyte Fuel Cell, SOFC - Solid Oxide Fuel Cell) (fig. 4c)

***After operating temperature***

low temperature cells (20-80 °C)

average temperatures cells (200-300 °C)

high temperatures cells (400-800 °C)

***According to the way of the fuel consumption***

**Indirect** - fuel passes through different turn before entering the cell;

**Direct** - For historical perspective among the pioneers of the modern fuel cells is also a Romanian physicist Nicolae Vasilescu-Karpen. In 1922, he patents the thermoelectric cell with uniform temperature also known as ***Karpen cell*** which is going to be built in 1950 and will continue working non-stop until today.

The device is composed by two cells connected in series which drives a small galvanometer engine. The small engine sets in motion a palette connected to a switch.

**Indirecte** - combustibilul trece prin diferite transformati inainte de a intra in pila;

**Directe** - din perspectiva istorica printe pionierii pilelor de combustie modern se afla, de asemenea, si un roman fizicianul Nicolae Vasilescu-Karpen.

In anul 1922 fizicianul roman Nicolae Vasilescu-Karpen breveteaza pila termoelectrica cu temperature uniforma cunoscuta si sub numele de ***pila Karpen***, care urmeaza a fi construita in 1950 si functioneaza fara oprire pana in ziua de astazi.

Aceasta este formata din doua pile electrice legate in serie care actioneaza un minimotor galvanometric. Minimotorul pune in miscare o paleta conectata cu un intrerupator. La jumatatea fiecarei rotiri paleta deschide circuitul, iar dupa cea de-a doua jumatate a rotirii il inchide. Timpul de rotatie al elicei este calculate astfel incat pilele sa se poata reincarca, adica sa re poata reface polaritatea in perioada in care circuitul este deschis. Functionarea neintrerupta de 60 de ani a pilei Karpen i-a detreminat pe multi sa o considere un perpetuum mobile.

Deoarece intre forma initiala de energie (chimica) si cea finala (electrica) nu exista nici un fel de alta forma de energie (termica sau mecanica) pilele de combustie realizeaza randamente ridicate ce depasesc, in mod teoretic, 80%.

**Domenii de utilizare a pilelor de combustie**

Propulsia cu ajutorul celulelor de combustie rezolva problema poluarii, fiind o alternativa la propulsia electrica deoarece nu mai exista neajunsuri cu privire la stocarea energiei electrice in baterii. Un

Halfway of each rotation, the circuit opens and after the second half of the rotation it closes. The time of rotation of the propeller is calculated so that its cells can be recharged, meaning to be able to restore polarity in the time that the circuit is open.

Uninterrupted working for 60 years of the Karpen cell has determined many to consider it a perpetual motion machine. Since between the initial form of energy (chemical) and final (electrical) there is no other energy form (thermal or mechanical) fuel cells achieve high yields that exceed, in theory, 80%.

**Areas of fuels cells use**

Powering by fuel cells solves the pollution problem, being an alternative at the electric propulsion because there are no limitations regarding the storage of electrical energy in batteries. A main drawback of this method of propulsion is hydrogen storage in pressure tanks, and building a distribution network for hydrogen. One solution would be ethanol-based fuel cells, manufactured from ethanol and vegetable mass waste, representing a renewable source of energy. Another area in which fuel cells are beginning to be used is principal inconvenient al acestui mod de propulsie este stocarea hidrogenului care face doar in recipienti sub presiune, dar si construirea unei retele de distributie pentru hidrogen. O solutie ar fi celulele combustibile pe baza de etanol, etanolul obtinut prin prelucrarea de masa vegetala si a deseurilor reprezentand o sursa regenerabila de energie.

Un alt domeniu in care pilele de combustie incep sa fie folosite este cel aeronautic. Astfel in anul 2008 cercetatorii Boeing au efectuat teste ale unui avion alimentat doar de o pila de combustie si baterii usoare. Acesta, numit Fuel Cell Demonstrator, folosea o membrane de schimb protonic si un sistem hibrid pentru alimentarea unui motor electric, care a fost cuplat la un propulsor conventional.

De asemenea submarinele de tipul 212 (fig. 6), folosite de marina italiana si germana, utilizeaza pile de combustie pentru a ramane sub apa timp de mai multe saptamani fara a fi nevoite sa iasa la suprafata.

Cea mai renumita pila de combustie folosita in domeniul industial este PC25 a firmei UTC (United Technology Corporation) ce are un randament electric de 40% si un

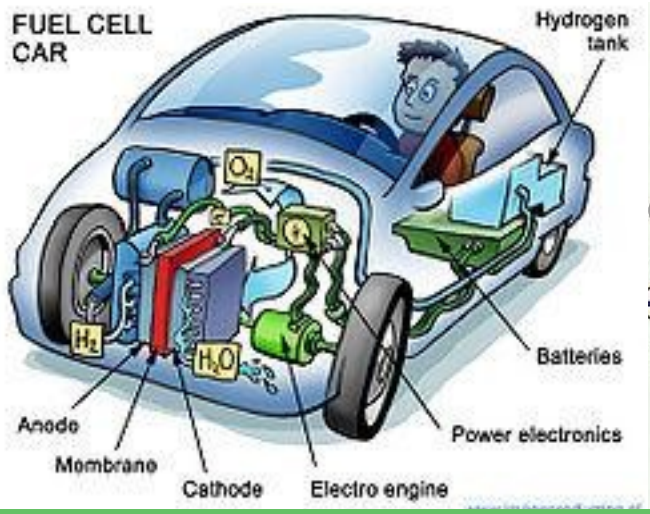



Figure 7

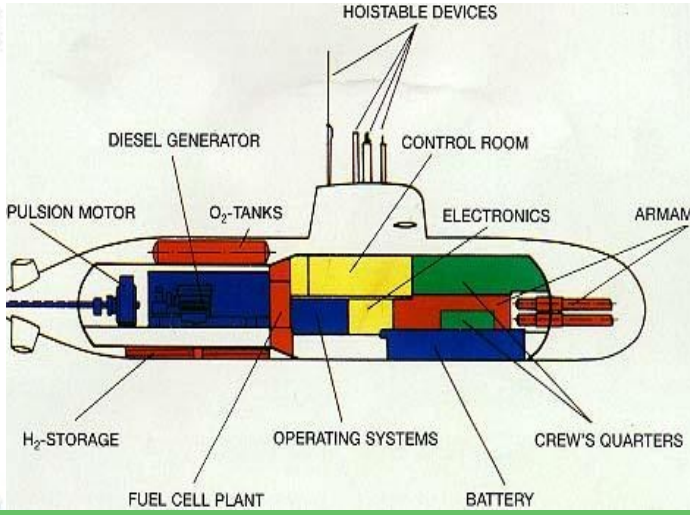



Figure 6

aeronautical. Thus in 2008, Boeing researchers conducted tests of an airplane powered only by a fuel cell and lightweight batteries. This was called the Fuel Cell Demonstrator, and used a proton exchange membrane and a hybrid system to power an electric motor, which was connected at a conventional propeller. Also 212 type submarines (fig. 6) used by Italian and German navy, use fuel cells to stay under water for several weeks without being forced come to the surface. It is expected that in the coming years fuel cells to increase their presence on the market of power generation devices and equipments.

The most famous fuel cell used in the industry field is PC25 manufactured by UTC (United Technology Corporation) which has an electrical efficiency of 40% and 50% thermal efficiency and delivers 200kW of electricity. It uses natural gas or biogas as fuel.

The fuel cell with alkaline electrolyte, AFC (Alkaline Fuel Cell) comes from Bacon cell and works at low temperatures up to 100 °C making 5-150kW power range. It is used in transportation, space program, military and energy storage systems.

Phosphoric acid electrolyte Fuel Cell, PAFC (Phosphoric Acid Fuel Cell), with porous electrodes made of teflon is used in the production of electricity and heat in decentralized stationary power systems, operating at temperatures between 160-220 °C and reaching a power between 50kW and 11MW. This is the most technologically advanced.

## Bibliography

www.ecolife.ro
www.fuelcells.ro
www.fuelcelltoday.com
www.eere.energy.gov
http://universulenergiei.europartes.eu/articole/energie/pile_de_combustie.pdf

randament termic de 50% si furnizeaza 200kW de energie electrica. Aceasta foloseste drept combustibil gazele naturale sau biogazul.

Pila cu electrolit alcalin, AFC (Alkaline Fuel Cell) provine din pila Bacon, lucreaza la temperaturi joase de pana in 100 °C realizand puteri intre 5-150kW. Aceasta este utilizata in transporturi,programul spatial, domeniul militar si sisteme de stocare a energiei.

Pila cu electrolit acid fosforic, PAFC (Phosphoric Acid Fuel Cell), cu electrozi porosi din teflon este folosita in producerea de energie electrica si caldura in sisteme energetice stationare decentralizate, functioneaza la temperaturi intre 160-220 °C si realizeaza o putere intre 50kW si 11MW. Aceasta este cea mai avansata tehnologic.

## Iconography

Figure 1 http://1.bp.blogspot.com/_reR1GNih3PU/SSjL2YRRupI/AAAAAAAAATU/HgEli8xNORM/s400/dendera-light-bulb+(double).jpg
Figure 2 www.greenpacks.org/wp-content/uploads/2009/04/baghdad-battery-components.jpg
Figure 3 www.greenpacks.org/wp-content/uploads/2009/04/baghdad-battery-components.jpg
Figure 4 http://galaxywire.net/wp-content/uploads/2009/05/apollo_fuel_cell.jpg
Figure 5 www.energobiologie.ro/index.php/Energii/O-sursa-inepuizabila-de-energie-pila-Karpen.html
Figure 6 www.naval-technology.com/projects/type_212/type_2122.html
Figure 7 http://upload.wikimedia.org/wikipedia/commons/e/e6/Fuelcell.jpg

# European Pupils *Magazine*

## Guidelines for contributors

Author(s) of original manuscripts who would like their work to be considered for publication in the **European Pupils *Magazine*** are invited to submit their papers as follows:

The topic of submitted papers has to be concerned with the **History** of **Science** and **Technology** or **Technology** for **Green Energy**. Papers may be the result of either personal research or classroom practice in the covered topics. Submitted articles should not have been published or being currently under consideration for publication elsewhere. Submitting an article with exactly or almost exactly the same content as found in publications of another journal or conference proceedings may result in the refusal of its publication. Submitted articles have to reach the editor in the **Author's mother tongue and in English**. Only if both versions are submitted and the submission form includes a list of 10 keywords in each language, it can be assured that the article is likely to be processed. If you find a **national referee** for your Country, send your article and the submission form to the given e-mail address. Otherwise, mail to one of the further mail addresses:

epmagazine.it@gmail.com
helerea@unitbv.ro
epmgreece@yahoo.gr
cristylacatus@gmail.com
ngeorgol@otenet.gr
ganges@alice.it
crina.stefureac@gmail.com

**Include in your mail:**

- **article in English (*.doc** or ***.rtf** format**);**
- **article in your mother tongue;**
- **FOUR pictures per page (at least) in single *.jpg format files;**
- **submission form filled and signed** (do not forget 10 keywords in your mother tongue, too).

Before adding the files as attachments, please make sure the tables and/or pictures are inserted in the proper place and the files can be opened without any problems.

Please, classify your manuscript into one of the following sections:

**General (Teacher's contribution)**
**News**
**Fun Pages**
**14 to 16 years old (Secondary school)**
**17 to 19 years old (Secondary school)**
**19 to 24 years old (University)**
**Technology for Green Energy**

Formatted articles should not **exceed 4 pages** (in A4 format) including tables, formulae and pictures. You have to be in the possession of the copy-right for submitted pictures and, in order to avoid any problems, with unauthorized reproduction, we suggest exclusive use of your own pictures. Each image source has to be cited in the **Iconography** at the end of the submitted paper. The images must be numerated in the caption i.e. (fig. 1) and in the iconography as well. To avoid problems with the quality of your pictures in the printed version we ask to submit pictures with a resolution of 300 dpi.

The **EP*M* Editorial Board** reserves the right not to publish all or some of the included pictures for copy-right and/or layout reasons. The last page of the submitted paper has to include the paragraphs:

**Bibliography**
**Iconography**

In the Bibliography the name of the Author(s), the title, the editor, its city and the year of publishing must be done. In addition, the optional paragraph **Acknowledgements** may be added. To help you submit a good article, we add some further recommendations that will avoid delay in publication and unnecessary work both for you and for our **Editorial Team**.

Please use as few special formatting procedures as possible in preparing your manuscript in the text processor. Texts should be written in a clear language without grammatical and/or spelling mistakes in order to make sure that the reader understands what you intend to say. If you are not sure whether your work is likely to be published, consult your national referee or the **Editorial Board** before submitting the finished article. Have a look at the published articles in the web-editions

www.epmagazine.org
epmirrorsite.xoom.it

Priority will be given to articles which are expected to interest a broader number of readers. This may particularly be the case when the covered topic corresponds with curricula in the **European Countries**. In case different submitted articles cover very similar topics, the **Editors** will also pay attention to a balanced geographical distribution.

**We are sorry to say that contributions without a clear scientific content, lack of originality, poor presentation and/or language, cannot be**

**EP*Magazine* is an International Educational Scientific Periodical published by a pool of Universities and European Secondary Schools. Contributions are welcome from every level of educational institutions, students and teachers.**
**THE VIEWS EXPRESSED IN THE ARTICLES DO NOT NECESSARILY COMPLY WITH THE EP*M* EDITORIAL BOARD'S ONES.**

E. BOGGIO LERA
LICEO SCIENTIFICO STATALE

***E. Boggio Lera***
**Catania, Italy**

***Experimental High School***
**Thessaloniki, Greece**

***Politehnica University***
**Bucharest, Romania**

***Transilvania University***
**Brasov, Romania**

# EPMAGAZINE

9 771722 696000
HST - EPMagazine ISSN